STATE OF CALIFORNIA
The Resources Agency

Department of Water Resources

BULLETIN No. 166-1

MUNICIPAL AND INDUSTRIAL WATER USE

AUGUST 1968

RONALD REAGAN
Governor
State of California

WILLIAM R. GIANELLI
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FOREWORD

This report shows the water used per person in the community and assesses the factors known to influence such use. Studies of this kind are essential in the determination of future water requirements for the people of California.

This bulletin, covering generally the period 1961 through 1965, is the first in a planned series of reports dealing with urban water use in detail on a statewide basis. Other Department of Water Resources reports dealing extensively with urban water use in California are Bulletin No. 2, "Water Utilization and Requirements of California", June 1955; Bulletin No. 124, "Water Use by Manufacturing Industries in California, 1957-1959", April 1964, and Bulletin No. 160-66, "Implementation of the California Water Plan", March 1966.

The studies leading to this report were initiated under the provisions of Senate Bill 434 introduced by Senator Edwin J. Regan and passed by the 1959 session of the Legislature of the State of California. Specific authorization for these studies is set forth under Section 226(e) of the Water Code. Under subdivision (e), the State may "conduct investigations of the rate of use of water for various purposes and considering the various soil conditions".

The information presented in this report was developed to indicate past and current rates of urban water use and to provide a basis for estimating future water needs. Even more importantly, this report presents average monthly unit water use values, values which heretofore were not available.

The unit values presented in this report are based on measured and estimated water deliveries and on estimated population figures. The resulting data and analysis enable those concerned with planning and development of water resources and the operation of water projects to make more reliable estimates of water requirements and demands for project water.

William R. Gianelli

William R. Gianelli, Director
Department of Water Resources
The Resources Agency
State of California
June 28, 1968

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The Resources Agency
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ACKNOWLEDGMENTS

The Department deeply appreciates the time and effort expended by many persons in public and private water agencies throughout the State in making available the data on water use and population. Without this cooperation this report would not have been possible. For the cooperation rendered by the following agencies the Department is particularly grateful:

California Water Service Company
East Bay Municipal Utility District
San Diego County Water Authority
Los Angeles City Department of Water & Power
State Public Utilities Commission

ABSTRACT

Average monthly per capita water use, based generally on 1961-65 records from water agencies serving 54 percent of the State's population, is highest in June and lowest in January. However, within individual hydrographic areas, departures from the normal high and low months were caused by the influence of manufacturing establishments on water use, the length of the growing season, and the sample not being large enough to mask out the unusual monthly values. / Per capita water use during the growing season was found to be greatest in the San Joaquin Valley and lowest in the North Coastal Area. The desert areas show lower per capita use than the San Joaquin Valley because less water is used for outside watering. / During the winter, per capita water use in areas of the State that have moderate to high rainfall, such as the North Coastal Area, or low temperatures, such as the high desert areas, consist almost entirely of inside water use. In low-rainfall, temperate areas, however, per capita use during the winter frequently is strongly influenced by outside uses of water. / Residential water use is greater in a hot, arid climate than in a moist, cool climate, but climate has little effect on industrial and commercial water use. / Of the 61 cities and areas in the State for which historic annual unit water use data are reported, per capita water use has shown essentially no change in 44 cities and areas, has declined in 13 cities and areas, and has increased in 14 cities and areas. Areas of recent general increase in urban per capita water use are the North Coastal Area, the San Francisco Bay area, the Sacramento River Basin, the Delta--Central Sierra Basin, and the San Joaquin River Basin. Per capita water use is approaching equilibrium in cities in the Central Coastal Area, the South Coastal Area, and the Tulare Lake Basin. / This report, the first in a planned series dealing with municipal and industrial water use, presents per capita water use values for agency-produced water and for private, industry-produced fresh and brackish water. The data is summarized by hydrographic areas, counties, and cities. Also presented is information on the techniques used in developing the data and on factors that influence per capita water use.

CHAPTER I. INTRODUCTION *

This report presents per capita water use values for cities, counties and hydrographic areas throughout the State. The values have been developed from available data collected from a large number of water agencies and from many manufacturing establishments producing their own water. In each of the areas studied, water use has been influenced by a distinctive combination of factors. Many of these factors are discussed in this report to assist the user in more effectively applying the unit values shown.

Summary

Monthly per capita water use, based on records from water agencies serving 54 percent of the State's population, is highest in June and lowest in January. However, within individual hydrographic areas, departures from the normal high and low months were caused by the influence of manufacturing establishments on water use, the length of the growing season, and the sample not being large enough to mask out unusual monthly values.

water use is greater in a hot, arid climate than in a cool, moist climate, such as that near the coast. However, climate has little effect on water use by large industrial and commercial users.

During the winter, per capita water use in areas of the State that have moderate to high rainfall, such as the North Coastal area, or low temperatures, such as the high desert areas, consist almost entirely of inside water use. In low-rainfall, temperate areas, however, per capita use during the winter frequently is strongly influenced by outside uses of water. This influence exists because vegetation does not go dormant and because watering is necessary to sustain the plants.

Per capita water use becomes more climate-dependent during the growing season with increase in evaporative demand, except in the desert areas. The desert areas show lower per capita use during the growing season than some areas of more moderate climate because less water is used for outside watering. This condition exists because residential lots are smaller, tend to be less extensively landscaped, and are frequently planted to low-water-using types of vegetation. Per capita water use during growing seasons is greatest in the San Joaquin Valley and lowest in the North Coastal Area.

* Definitions of commonly used terms and abbreviations are presented in Appendix A.

Of the 61 cities and areas in the State for which historic annual unit water use data are reported (Table 11), per capita water use has shown essentially no change in 34 cities and areas, has declined in 13 cities and areas, and has increased in 14 cities and areas. General area-wide increases in per capita water use have occurred in the North Coastal Area, the San Francisco Bay Area, the Sacramento River Basin, the Delta--Central Sierra Basin, and the San Joaquin River Basin.

Per capita water use in cities in the Central Coastal Area, the South Coastal Area, and the Tulare Lake Basin is approaching equilibrium. Of the 44 cities in these areas for which unit water use data are reported (Table 11), 60 percent show little, if any, trend in per capita water use in the 15 years from 1951 through 1965. During the period 1958-62, these same cities reached a peak use, then declined slightly and stabilized.

Selection of Water Use Units

The water use units used in this report are gallons per capita per day (gpcd). These units have been found to be the most reliable for determining urban water use.

The selection of per capita units has been strongly influenced by the general procedure now used in the Department and shown in Figure 1 for calculating municipal and industrial* water use. Data of suitable quality and in sufficient quantity are available or easily acquired to make unit use calculations on this basis. On the other hand, use of area-depth units requires considerable effort, expense, and difficulty and lacks the flexibility for adjusting to new water use conditions that is inherent in the per capita approach.

Gallons per capita per day can be readily applied to residential, commercial, and recreational water use and to many smaller categories. The only urban water use for which per capita units have limited usefulness is industrial use, since normally there is little relationship between a community's changing population and its industrial use of water or between the area of industrial establishments of the same type and their use of water.

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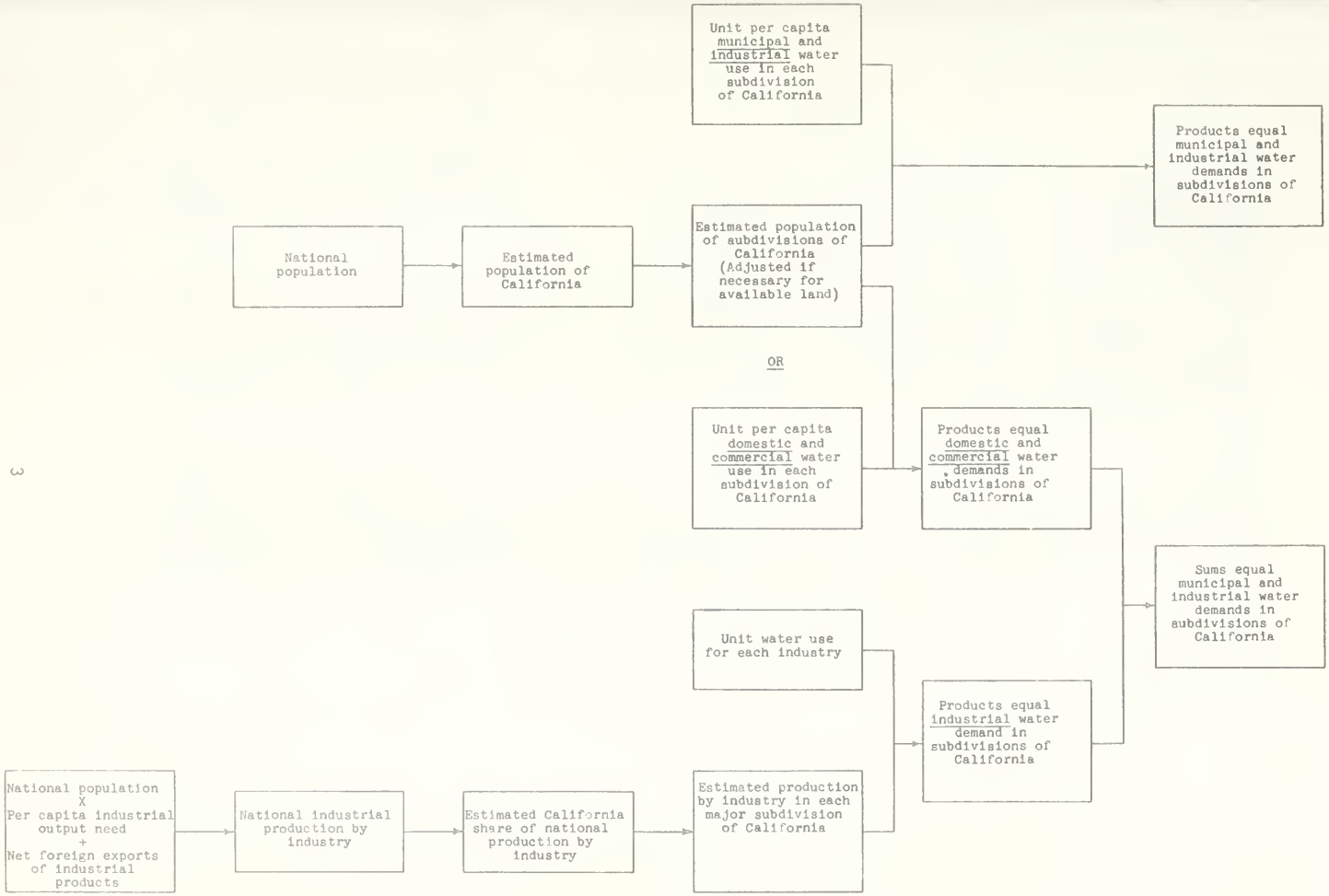
* Henceforth abbreviated M&I. In this report, the terms M&I and urban water use are used interchangeably.



TYPICAL FLOW CHART FOR
MUNICIPAL AND INDUSTRIAL WATER USE COMPUTATIONS

Figure 1

For industrial water use, employee-working-day unit values were found to provide a useful and reasonably accurate means for expanding reported uses of water by a segment of each industrial group to determine use for the entire group. These unit values and calculations, presented in Bulletin No. 124, were used as the basis for deriving per capita unit values for this report for counties or larger areas. The use of larger areas tends to dampen small-area fluctuations and to make the industrial water use values more population-dependent.

Composition of Urban Per Capita Water Use Values

Representative urban per capita water use values consist of values for agency-produced water and for privately produced water. Because the amount of available data on privately produced water in residential areas and commercial establishments is negligible, the only privately produced water that was considered was that produced by manufacturers. This water is divided into two categories: fresh and brackish.

Although considerable annual data were available on fresh and brackish water use by manufacturing establishments, monthly data were not available. Therefore, monthly per capita urban water use values are based exclusively on the use of agency-produced water. Future reports will contain data on the extent to which private, industry-produced water can alter monthly patterns of agency-produced water.

Types of Water Service Agencies

Municipal and industrial water service in California is provided by three types of water service agencies: publicly owned nonprofit agencies, privately owned nonprofit agencies, and privately owned profit-making agencies. These agencies do not include those individuals and companies that pump or divert water for their own use. In 1962, about 3,700 organizations were concerned with distributing water to the public in California.* Of these about 200 were municipally owned, 500 were commercial water companies, 1,400 were incorporated or unincorporated mutual groups, and 900 were water districts.

Uses of M&I Water

M&I water use consists of all uses of water associated with man, other than agricultural uses. In rural areas, residential water use includes some overlap between M&I and agricultural use. Water use at home sites that include

* Bulletin No. 114, "Directory of Water Service Agencies in California", June 1962.

a dwelling and an orchard or truck garden normally becomes an agricultural use if the area is larger than about 2 acres. This does not include large estates with extensive ornamental shrubbery and lawn areas.

In residential areas there are three primary uses of water.

1. Outside Uses (lawn and plant watering, swimming pool, car washing, and driveway sweeping).

2. Household Uses (clothes washing, dishwashing, garbage disposal, cooking and food preparation, evaporative coolers, and house cleaning).

3. Personal Uses (toilet flushing, bathing, other personal hygiene, and drinking).

Commercial establishments use water for many of the same purposes listed for residential areas. In addition, water is used in the form of steam or liquid for many types of commercial purposes.

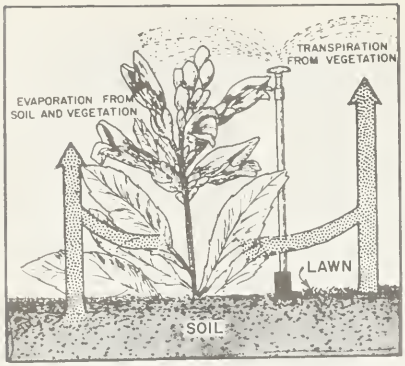
Industrial manufacturing establishments also use water for many outside, household, and personal purposes. Normally, the bulk of industrial water is used for cooling or for some industrial purpose.

Recreational water use includes residential and commercial uses, although usually in much smaller amounts than in urban areas.

Applied Water Components

Figure 2 shows a once-through disposition of water applied to an urban area. Also shown is the unaccountable water component which comprises water uses and losses not easily ascertainable.

Consumptive use, which is usually the largest of the three components comprising the applied water fraction, consists of two parts. Outside consumptive use consists of water used by urban-associated vegetation in transpiration and building of plant tissue, and water evaporated from soils, water surfaces, plant foliage, and impervious surfaces. Inside consumptive use consists of water evaporated during cooling, cleaning, and food preparation processes associated with residential, commercial, and industrial uses. Usually, only a small quantity of water is consumed or "lost" from the system in this manner.



OUTSIDE CONSUMPTIVE USE

"Outside consumptive use consists of water used by urban associated vegetation in transpiration and building plant tissue, and water evaporated from soils, water surfaces, plant foliage, and impervious surfaces."

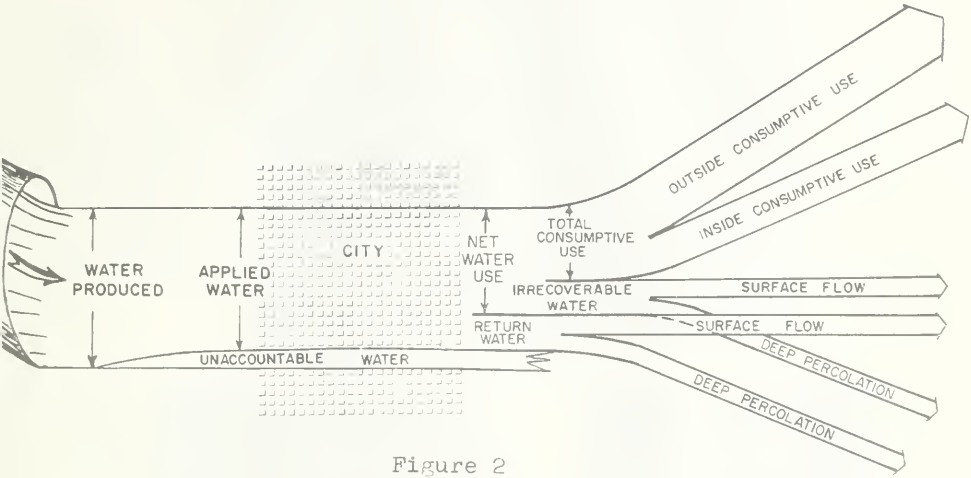


Figure 2
COMPONENTS OF URBAN WATER USE

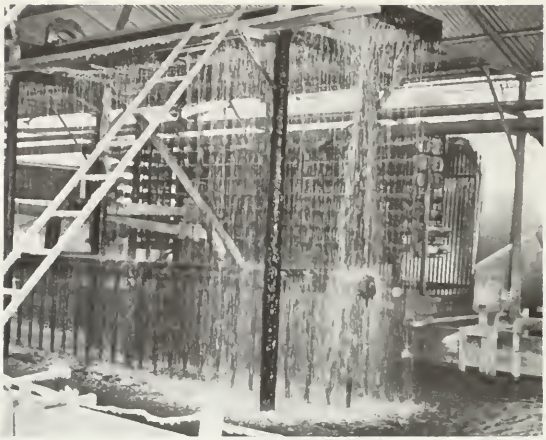
Irrecoverable water is water which either has been degraded in quality so that it is unsuitable for reuse* or has been discharged directly to the ocean or some other land or water body where it no longer is recoverable.

Consumptive use and irrecoverable water constitute net water use, or the amount of applied water actually lost from the water system. At present, little is known about the nature and magnitude of this value for urban complexes. The meager net water use data available relates mainly to industrial use.

Return water is not included in net water use because it can be recovered for reuse. It includes water which leaves the urban area surface by flow (to be picked up at some downstream point) or by deep percolation.

It should be recognized that Figure 2 is only a schematic and that no attempt has been made to depict an average or even a reasonable relationship of the components. The number of components and the volume of each can vary greatly between urban areas.

*Suitability for reuse is determined by economic considerations based on current methods of reclaiming water.



INSIDE CONSUMPTIVE USE

"Inside consumptive use consists of water evaporated during cooling, cleaning...processes associated with residential, commercial, and industrial uses."

Study Boundaries

In the selection of study boundaries, consideration was given to boundaries that would remain relatively stable in the future, would be hydrologically complete, and would be expected to be used for most planning studies. The regional boundaries selected were the hydrographic areas established for Bulletin No. 2, "Water Utilization and Requirements of California", modified in one area to permit comparisons with more recently established boundaries. These boundaries are shown on Figure 3. The modification consisted of detaching the northern portion of the San Joaquin River Basin from the basin shown in Bulletin No. 2 to form the Delta--Central Sierra Basin.

Future Activities

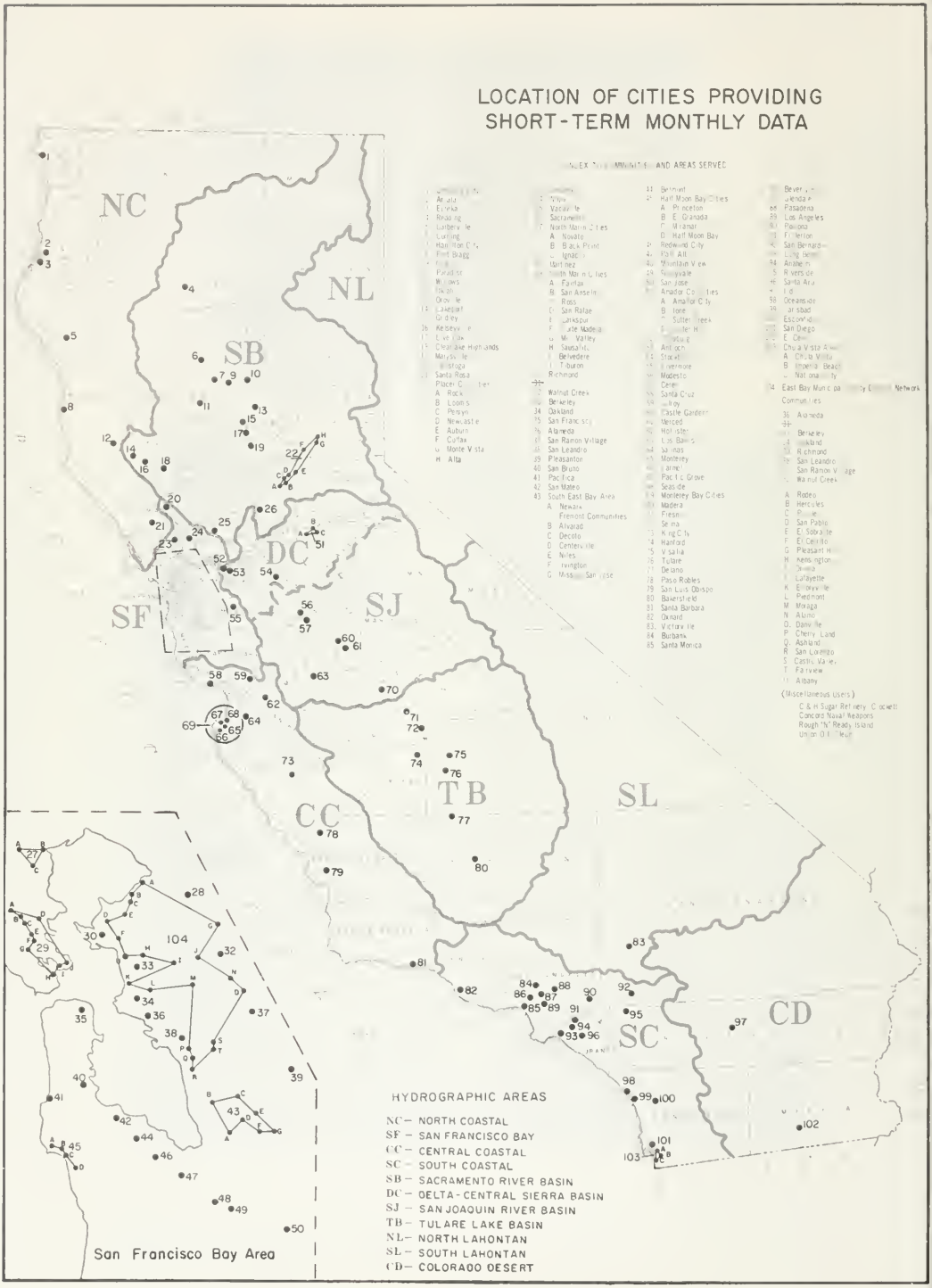
The Department will continue periodically to monitor per capita M&I water use of communities throughout the State. Where necessary and possible, information on privately produced water will be collected and related to population to obtain total per capita use for a given area.

In accordance with planning requirements for industrial water use information, unit use values will be developed for major industrial categories and possibly for certain individual industries. Available data will be supplemented with new data as required to develop unit values on a unit-of-product or dollar-value-added basis.

Data will be obtained on the proportion of total M&I water that is applied outside of buildings and the proportion that is disposed of as sewage in the San Francisco Bay and South coastal metropolitan areas.

Data on annual and seasonal per capita unit water use in recreational areas will be obtained where such use is or will be significant.

In the major metropolitan areas, the factors that may significantly affect per capita M&I water use will be monitored. Where appropriate, municipal and industrial use will be monitored separately. If necessary, studies will be initiated to quantify the most important factors.


LOCATION OF CITIES PROVIDING
SHORT-TERM MONTHLY DATA
NC
NL
SB
DC
SF
SJ
TB
SL
CC
SC
CD
San Francisco Bay Area
HYDROGRAPHIC AREAS
NC— NORTH COASTAL
SF — SAN FRANCISCO BAY
CC — CENTRAL COASTAL
SC — SOUTH COASTAL
SB — SACRAMENTO RIVER BASIN
DC — DELTA-CENTRAL SIERRA BASIN
SJ — SAN JOAQUIN RIVER BASIN
TB — TULARE LAKE BASIN
NL— NORTH LAHONTAN
SL— SOUTH LAHONTAN
CD— COLORADO DESERT

CHAPTER II. FACTORS AFFECTING URBAN WATER USE

Factors that tend to increase or decrease unit values for urban water use have been quite well identified.* However, relatively little attention has been given to the importance of each to urban water use or to the development of a means of predetermining, quantitatively, the net effect of a given set of variables on such use that will apply to a wide range of geographic, economic, and climate conditions. However, enough is known about the more important influencing factors to permit a qualitative evaluation of them. This evaluation will provide a useful basis for comparing water use between communities and areas, for developing an understanding of past water use trends, and for gaining an insight into future trends.

The factors which influence Municipal and Industrial Water Use rates may be grouped into two broad categories:

1. Climatic Factors
2. Man-Made Factors

Climatic Factors

Throughout most of California, climate is the predominant influence on M&I water use. In the hot, low-rainfall areas of the State, a close relationship usually exists between climate and urban water use due to the high outside use of water by vegetation. In the areas immediately adjacent to the coast, high humidity, foggy weather, and cool sea breezes may suppress outside use sufficiently to permit the non-vegetative, or inside use, components to determine the rate of use.

The influence of climatic factors is felt in two ways. Outside the home, the collective effect of various climatic factors determines the rate at which water is evaporated from wet surfaces and transpired from plants. This, the "evaporative demand", is the most important influence of climate. Inside the home during the summer, climate exerts a direct influence on use when man uses water for cooling to

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* Partial list:
"Domestic Water Use Planning", MEVA Corporation
"A Study of Residential Water Use", Federal Housing Administration, U.S. Department of Housing and Urban Development
"Water Use in the Mineral Industry", U.S. Bureau of Mines
"Water Use by Manufacturing Industries in California 1957-59", Bulletin No. 124, Department of Water Resources, State of California
"Factors Affecting Consumption of Urban Household Water in Northern Utah", Garder, B.D. and Schick, S.H. Bulletin 449. Agricultural Experiment Station, Utah State University. November 1964.

maintain a desirable comfort level. During June, July, and August, the water used for this purpose in the State's inland areas is appreciable. On the other hand, where refrigerant rather than water coolers are used, climate has little effect on inside use.

Temperature

Very little evaporation data has been collected in urban areas which can provide a good index of evaporative demand. However, to demonstrate the influence of climate on outside water use, temperature data, because of its availability and generally close relationship to outside water use, provides as good an index as does any single climatic factor.

To help isolate the temperature factor from other influencing factors such as rainfall and family income, the urban areas used in the examples below generally met the following requirements:

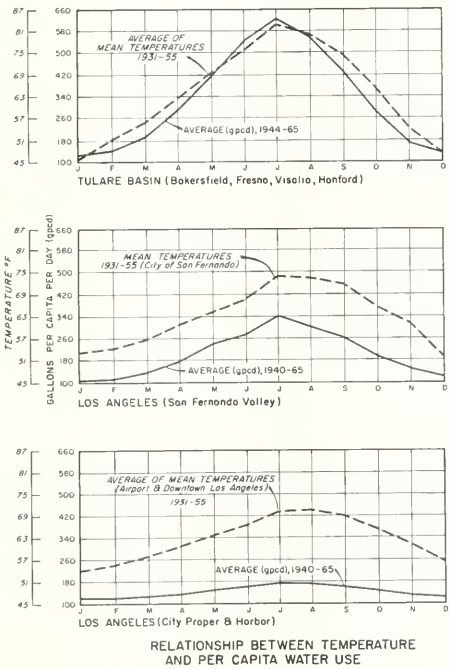
- Similar urban composition
- Extensive vegetated areas
- No special water use restrictions
- Large seasonal climatic fluctuations

The Department of Water Resources, in a study made in 1959 and reported upon in Bulletin No. 78, "Investigation of Alternative Aqueduct Systems to Serve Southern California", evaluated a number of factors believed to influence M&I water use. The investigators determined that the rate of water use is particularly sensitive to temperature fluctuations. This was demonstrated by plotting the monthly mean temperature for a particular city together with monthly water production for that city in three separate climatic zones in Southern California. The resulting water production curves closely followed the rise and fall of the temperature curves. The three areas and the average urban per capita water use for three periods are presented below.

Area	Description	Average Urban Per Capita Water Use (gpcd)		
		1929-33	1953-56	1960
1	San Luis Obispo, Santa Barbara, Ventura, Coastal Los Angeles, and Orange counties	130	160	163
2	San Fernando and San Gabriel Valleys	140	190	214
3	Antelope-Mojave Desert and the Upper Santa Ana River Basin	148	212	231

The two main causes given for the higher use of water in the Antelope-Mojave Desert and the Upper Santa Ana River Basin area were evaporative air-conditioning and the extra water needed to sustain trees, shrubs, grass and other plants used for landscaping. The lower temperatures in the San Fernando and San Gabriel Valleys as shown in Figure 4, are largely responsible for the lower per capita use in this area. The curves show the relationship between long-term per capita water use and temperature data in two areas of Los Angeles and in the Tulare Lake Basin. Although the shapes of the curves are similar, the magnitude of the influence of temperature diminishes with approach to the coast. This occurs because summer fogs and ocean breezes introduce other climatic factors that lessen the temperature effect.

Figure 4



RELATIONSHIP BETWEEN TEMPERATURE AND PER CAPITA WATER USE

Other Climatic Factors

Rainfall, humidity, and wind also influence urban water use. Because the frequency and intensity of rainfall is quite variable, not only from area to area but with respect to time, the influence of this factor is also quite variable.

During growing seasons, for instance, an increase in the effective precipitation, which usually occurs during late spring and early fall, will generally reduce urban water use. Because of large yearly variations in spring precipitation, applied water requirements for urban areas during that season also fluctuate greatly. The greatest fluctuation usually occurs in March or April (Figure 10, Chapter IV).

In winter, vegetative water use requirements are very low. Dormancy, or near dormancy, of many species sharply reduces the need for water, and the remaining need can be more than satisfied by normal winter rains. On occasion, long rain-free periods do occur and gardens must be irrigated to sustain growth.

The amount of precipitation does not appear to be as important as when it occurs. A study by the Department in Southern California disclosed that while the rainfall in two years was 3.9 inches and 14.5 inches,* the total irrigation water applied during the second year to the lawns and shrubs of the 12 test homes decreased only 11 percent. During the first year, precipitation had been more or less evenly distributed, but most of the total precipitation during the second year occurred in one month. Thus, precipitation, depending upon its distribution, may or may not be an important influence on the amount of urban water use.

Outside water requirements generally decrease as humidity increases. Humidity is increased not only by proximity to the ocean or other bodies of water but also by irrigation and by extensive areas of vegetation. Data recorded at Fresno over a period of 75 years indicate a significant rise in summertime humidity, which coincides with the increase in acreage of irrigated land in the Central Valley during this period.

Daily measurements at the University of California at Davis indicate that wind accelerates evaporation and transpiration from water surfaces and plants. On excessively windy days plants may exercise partial control in the release of water. Moisture loss from free water surfaces or wet soil surfaces, however, increases proportionately to air movement.

Man-Made Factors

Factors influencing urban water use which are controlled by the people living and working in urban areas are conveniently grouped into two categories:

- Residential-Related Factors
- Other Urban-Related Factors

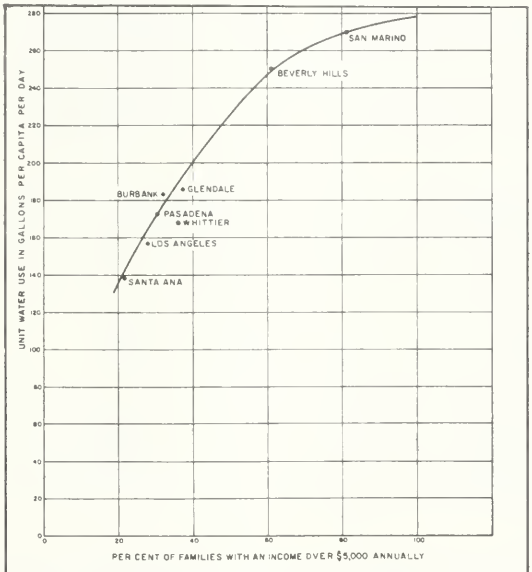
* "Residential Unit Water Use Survey, Rossmoor Tract, Orange County for the Period, April 1960-April 1962", November 1965, Office Report

Residential-Related Factors

Because most of the water used by a balanced urban community is used in residential areas, the residential-related factors of economic level, price of water, family size and age, metering, and sewering generally influence total urban use more than other man-made factors.

Economic Level - A number of researchers* have established that the economic level of the consumer influences water use. This relationship was also confirmed in analyzing data for Appendix D (Economic Demand for Imported Water) of Bulletin No. 78, when the urban per capita water use and family income for 1950 were charted for eight communities in Southern California. The results are presented in Figure 5. Although the per capita values represent all urban uses rather than only residential use, values for the latter would give the same results.

Figure 5



RELATIONSHIP BETWEEN UNIT URBAN WATER USE AND URBAN FAMILY INCOMES IN 1950

* - Larson, B. O. and Hudson, Jr., H. E., "Residential Water Use and Family Income", Jour. AWWA, August 1951.
- Hanson, R. and Hudson, Jr., H. E., "Trends in Residential Water Use", Jour. AWWA, Nov. 1956.
- Federal Housing Administration, U. S. Department of Housing and Urban Development, "A Study of Residential Water Use".
- Dunn, D. F. and Larson, T. E., "Relationship of Domestic Water Use to Assessed Valuation with Selected Demographic and Socio-Economic Variables", Jour AWWA, Apr. 1963

These studies agree that water use generally relates to family income, but they provide no quantitative correlations. While the reasons given for this vary between investigators, there appears to be general agreement that outside water use is most responsible for the correlation in most climatic zones. This is because the lots of homes of higher-income families are generally larger and therefore have higher sprinkler requirements.

Where climate or some other condition results in small outside use, opinions differ on whether the correlation will still hold. The study on residential water use conducted by the John Hopkins University for the Federal Housing Administration* indicates that the correlation does hold. This conclusion is based on a regression analysis of measurements of winter use of homes at various economic levels. Outside use was assumed to be negligible during the winter period**. The results gave a correlation coefficient of 0.76 within 95 percent confidence limits. No attempt was made to determine the contribution of personal and household uses in the correlation. The explanation offered for the correlation is that the consumer in a higher-valued area "is likely to have more water using appliances". Also, the appliances tend to be operated more frequently and at higher-than-average consumption rates.

Price of Water - The selling price of water is another economic factor which affects the rate of water use, but to a minor extent. In agricultural water use, as the price of water increases, its use decreases. This tendency in urban water use seems to be offset, however, by a sliding-scale pricing system used by most utilities, which varies the price of water inversely with the quantity used.

For cities reporting to the State Controller that showed an increase in price of water over a number of years, there generally did not appear to be any lasting reduction in use. Price caused a temporary reduction in usage following an increase in water charges but quickly rose to equal or exceed the previous rate.

Family Size and Age - The total water requirements of older dwellings in a community are usally less than those of younger dwellings, but per capita use is usually greater.

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* "A Study of Residential Water Use", Federal Housing Administration, U. S. Department of Housing and Urban Development, 1967.

** The patterns of winter use for various cities in the San Joaquin Valley indicate this assumption may not be valid in low rainfall temperature climatic zones. (See Chapters III and IV)

The reduced dwelling requirements occur as the occupancy of homes changes from young families with children to older citizens whose families have matured and moved away. Per capita use increases under these circumstances because outside use remains essentially unchanged.

Conversely, increasing the size of the family will increase inside use but again will have little effect on the high fixed outside uses. The net result is a lowered per capita use.

This cause-and-effect relationship is borne out in an analysis made in the MEVA Corporation Report of the study by Dunn and Larson investigating water use in 208 households in an Illinois town. The analysis showed that per household use increases almost linearly with increase in family size (except for one person per household, where the use is less than would be extrapolated). Conversely, the per person use decreases as the number of persons per household increases (again, excluding the case of one person per household). The deviation for the case of one person per household may be due to the fact that in such households the occupant is away from home frequently or makes more frequent use of outside facilities, such as restaurants and laundromats.

Metering - In an unpublished study of metered versus unmetered water use in 12 San Joaquin Valley cities, the Department of Water Resources found that metered use averaged about 42 percent less than unmetered use. The results are presented below:

1957 Data

	Metered Use						Unmetered Use 1/					
San Joaquin Valley Cities	Hanford	Arvin	Sanger	Lindsay 2/	East Bakers-field	Los Banos	Merced	Madera	Delano	Selma	Oil-Dale	Atwater
Average Daily Water Use (1,000 gals)	3,814	619	960	1,605	1,725	975	6,446	4,696	3,837	2,440	4,486	3,000
Population Served (1,000)	15.3	6.0	8.2	5.5	11.6	5.8	23.4	14.0	11.1	6.8	16.6	6.8
Gallons Per Capita Per Day (gpcd)	249	102	117	292	149	165	276	335	346	358	270	439
Weighted gpcd	184						316					

1/ Meters occasionally used on some large users.

2/ Includes consumption by large olive processing firm.

In the Federal Housing Administration's report on residential water use, the per-dwelling use of water in 10 metered and 7 unmetered areas in the western United States were compared. The comparison, presented below, shows that metered use was approximately 34 percent less than flat-rate use.

Type of Use	Metered Use (10 Areas)	Flat-Rate Use (7 Areas)
	gallons per day per dwelling unit	
Personal and Household	247	236
Outside	186	420
Leakage	25	35
TOTAL	458	690

The 34 percent figure is very closely approximated by results of a study done by the staff of "Water and Sewage Works"*. The report stated that cities with more than 99 percent metering used approximately 32 percent less water than those with less than 50 percent metering. Langbein found at Ottawa,Ontario, that 100 percent metering lowered the daily per capita water consumption by 29 percent**.

The extent of metering in California varies greatly from area to area and even from city to city. In the San Francisco Bay and Los Angeles areas metering is practically universal and has been accepted by the consumers as part of their service. In many parts of the Central Valley and other outlying parts of California, however, much opposition exists to the use of meters. Even so, metering eventually is expected to become a common practice throughout the State.

Water agencies go to metering because they feel it is more equitable and businesslike to charge the consumer for the water actually delivered. Metering also results in better record keeping and stimulates water conservation, a subject of increasing emphasis in our society. Further and perhaps more important, metering results in reduced distribution costs. Initially, costs are higher because of costs in purchasing equipment, installing an accounting system, and reading the meters, but eventually this is offset by lower power and maintenance costs.

Sewering - Five of the 36 areas studied in the FHA residential water use study used septic tanks rather than sewers. Water use in these areas was found to be significantly less than in the sewered areas. The relationship developed in the 31 sewered areas between per dwelling water use and market value of the home was used as the basis for predicting water use in the septic tank areas. The results gave a 32 percent higher value than actual - the increase that would be expected with conversion from septic tanks to public sewers.

* Study published in edition of September 15, 1958, Page R-116

** Langbein, W. B., and Leopold, L. B., "A Primer on Water" USGS, 1960

In contrast to the sewered areas, water use in the septic tank areas was found to be unrelated to economic level but apparently directly related to population density. The reason for this relationship (and the smaller use) appears to center around the consumer's concern that his septic tank will require more frequent cleaning. The factors responsible for this relationship, however, are not known.

Miscellaneous - Increased use of water-using appliances can be expected to produce a significant increase in household and, to a lesser extent, per capita use*. This belief is supported by the following observations:

1. Addition of a garbage disposer introduces an entirely new water requirement.

2. Replacing hand methods of dish and clothes washing with automatic appliances increases these water uses by as much as 40 percent**.

3. Market studies by the electrical industry indicate that purchases of electrical appliances are increasing faster than net take-home income is increasing. Because a great many homes do not yet possess all of the water-using appliances (or even one), this trend can be expected to increase residential per capita use for some time into the future.

Air coolers have been relied upon for many years to increase comfort in homes in the Central Valley and desert areas where outside temperatures often approach or exceed 100 degrees Fahrenheit. The original evaporative water coolers are fast being replaced with refrigeration-type coolers. This lowers per capita use. New home units will probably be of the type which use the refrigeration principle.

The addition of a swimming pool to a lot is often assumed to have no appreciable effect on per capita use providing it displaces an equal amount of lawn. The assumption implies

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* At least in the near future. Home recirculation systems are currently being investigated which, if introduced, would make these increases of little consequence.

** Horowitz, H., "A Study of the Effect of Automatic Sequence Clothes Washing Machines on Individual Sewage Disposal Systems", Natl. Acad. of Scis-Natl. Research Council Publ.442, Building Research Institute (1956)
-Watson, K.S., "Water Requirements of Dishwashers and Food Waste Disposers", Jour. AWWA, May 1963
-Proctor & Gamble Co. (A national survey of water requirements for dishwashing)
-Ohio Agricultural Experiment Station (Bulletin of May 1956)

that evaporative losses from the pool are essentially the same as would occur if the pool area were in lawn and ornamentals. Because of splash losses and occasional pool draining for repairs and maintenance, actual use is believed to be somewhat higher.

The influence of water pressure on per capita use is not well understood. The study by Watson indicates that high pressures increase both rate of use and total quantity of water used by garbage disposers but has no effect on dishwater use. The conclusion reached in the Federal Housing Administration's report is that high pressures may increase the rate of use but that the time an appliance would be operated would be decreased and the total quantity would remain constant. This latter conclusion would appear to be the most reasonable until more substantive research is accomplished.

Water rationing during critically dry periods, such as restrictions on car washing or lawn sprinkling causes considerable reduction in the average per capita water use. Imposition of sprinkling restrictions in Detroit in 1952 resulted in more than a 17 percent decrease in total community use.* This decrease could have been much greater, but sprinkling was prohibited only between 10 a.m. and 9 p.m.

Normally, once restrictions are lifted, per capita use returns to prerestriction levels. An exception to this was noted in the study by Hanson and Hudson in which residents of a town in Illinois found they could get along with less water.

Other Urban-Related Factors

The other urban factors discussed in this section would only modify water use rates in a balanced community, where water use is dominated by the residential component. However, where high-water-using industries exist, the per capita rate might be influenced primarily by the industrial component.

Greenery - Generally the higher the proportion of vegetated area in a community the greater will be its per capita use. Although some older communities, such as the core area of Sacramento, have a high vegetation factor because of tree canopy, in most instances the higher proportion of greenery will be found in the newly constructed or expanding cities. This is due to larger home lot sizes, greater setback requirements from streets, and the more extensive landscaping of homes and all other categories of urban use than has been the custom in the past.

*"Effect of Sprinkling Restrictions", Heggie, G. D. Jour. AWWA. March 1957.

Building regulations requiring homes to be set back farther from streets than in the past result in more greenery and greater outside use of water.

"Current city and county planning studies call for more extensive use of green-belt areas of public parks and quasi-public open spaces, much of which will be irrigated."

CHANGES IN OUTSIDE WATER USE

Current city and county planning studies call for more extensive use of green-belt areas of public parks and quasi-public open spaces, much of which will be irrigated. In Santa Clara County for example, this type of land use has increased by more than 1,500 acres in six years. Other counties are similarly providing for additional open space, which calls for irrigation and/or additional water use.

Kind of Community - A number of sizable communities around large population centers are essentially residential. They are within commuting distance of primarily industrial or financial centers. In such communities, unit water use values are set primarily by residential requirements and influenced by prevailing climate.

As communities enlarge, they tend to become more self-sufficient and acquire their own light manufacturing and service facilities. Most of the cities in the State fit into this category.

The development of a community into a highly industrialized area will usually increase per capita use appreciably. Within the San Francisco and Los Angeles urban complexes, there are several highly industrialized cities where water use is considerably higher than would normally be expected. The Department of Water Resources, in Bulletin No. 124, indicated that industries associated with food, lumber, paper, petroleum, chemicals, and clay and glass products have high water requirements with respect not only to total intake but also to unit values based on employees and plant area. In cities where any of these products are manufactured, per capita water use is higher than in adjacent cities of balanced land use.

A number of areas throughout the State have communities which can attribute their origin and growth to recreation. Other communities have become recreation-oriented after their initial development. In such areas, population fluctuates markedly from midweek to weekend and from season to season. Total water use is high during the vacation season, but diminishes at other times of the year. The kinds of water use in these recreational areas are much the same as in any urban area, except that there is almost no manufacturing use. Although the kinds of water use are essentially the same in both recreational and other urban areas, outside water use in recreational areas may be quite low because landscaping, when present, often consists of ornamentals and native plants that can thrive under natural rainfall conditions. Inside use of water frequently is greater than outside use but still less than inside use elsewhere because

"...Outside water use in recreational areas may be quite low because landscaping, when present, often consists of ornamentals and native plants that can thrive under natural rainfall conditions."

RECREATIONAL OUTSIDE WATER USE

fewer water-using appliances are present and/or because daytime occupancy of dwellings is less. The recent increase in construction of resort motels and larger residences at such areas will increase population densities and total water requirements. Per capita use should also increase because water use by recreational areas, while quite low during their early stages of development, increases during later stages because of greater outside use.

Another kind of community with unique water use characteristics is the agricultural-residential type. In most instances, such areas were originally high-income orchard lands. These orchards were developed into 1-to 5-acre home lots, essentially retaining the agricultural nature of the area. An example of this sort of development is the City of Carlsbad, a coastal community in Southern California, once an avocado orchard area. Because some income is derived from this crop, the trees are well watered and cared for. Per capita water use in such communities is much higher than in communities with otherwise similar characteristics.

Changes in Community Aspect - The areal relationship between various land use categories in an urban area changes constantly. For this reason, trends in water use are often difficult to explain. As cities enlarge and age, the older core areas often are converted to higher or more intensive types of use, either for profit-motivated economic reasons or because of urban renewal programs. Single-family dwellings give way to apartments, condominiums, and commercial establishments, while commercial and manufacturing establishments give way to similar but more intensive use. The net effect of such old-town "second-cycle growth" or "recycling", as it is called, is to increase population density and lower per capita use. Most major counties and many cities throughout the State now have master plans which propose orderly development of urban and open lands. The use of these plans in conjunction with unit water use values for the major urban categories should provide a useful basis for projecting future requirements of recycled areas and expected urban developments.

In a small city, the addition or removal of a single water-using entity of significant size can noticeably increase or decrease the city's demand for water. For example, the average daily per capita water use in Ukiah, exclusive of the water used by a company that manufactures press-board, is about 200 gallons. When the water use of this company is included, the per capita use is increased to about 560 gallons. Such an effect probably would not be felt in communities with populations exceeding 150,000.

Changing Industrial Water Requirements - Changing industrial water requirements in the major manufacturing centers of California are principally due to more efficient water use, changing industrial patterns, changes in industrial processes, and new industries. Industrial water requirements in Santa Clara County, for example, are markedly decreasing because of a change from food processing plants to light industries, such as electronics, precision instruments, research, and related groups.

Increased cost of water supply and disposal also can modify water use requirements. As water becomes more expensive and as stricter governmental controls increase, the costs of maintaining the quality of waste discharges, industrial users will be motivated to seek industrial processes using less water, to convert plant systems to permit greater reuse of water, or to develop their own water supplies. As an example of the influence of cost, recirculation has reached its highest refinement in areas where imported water, at higher than local water costs, constitutes a major portion of the supply. Data in Bulletin No. 124 by the Department indicates that about double the quantity of water now used by manufacturing industries would be required if water were not reused.

In contrast to the trend toward water conservation in certain industries, some manufacturers are using more water, such as for moving the product within the plant. Others are finding new water uses associated with new types of machinery.

Where present water requirements may be based on the relationship between number of employees and water use, automation can quickly invalidate such values. For example, automation in manufacturing has reduced the number of employees per unit of product, thus raising the unit water use values based on the employee. Employee unit water use values presented in Bulletin No. 124 may still be usable but probably will not remain valid much longer in those manufacturing groups which are rapidly acquiring automatic equipment.

Water Production and Use Measurements - Most of the water produced for use in the major metropolitan centers is measured accurately. Some of the smaller systems, however, are not equipped with meters and must rely on power records for estimating their use. Where water is obtained from wells with fluctuating ground water levels, such estimates can vary considerably from actual use unless consideration is given to attendant changes in power consumption necessary to maintain a given rate of flow.

Illustration 5

WATER USED FOR TRANSPORTING INDUSTRIAL PRODUCTS

"... some manufacturers are using more water, such as for moving the product within the plant." (Asparagus being transported by water through a dicer)

Illustration 6

EXAMPLE OF UNACCOUNTABLE WATER

One of the components of "unaccountable water" is the water tapped from an agency's water system for use on construction jobs.

Some agencies completely meter their customers but do not meter their source of supply. Thus, the total quantity of water introduced into the system can only be estimated. Throughout most of the State, this condition is rapidly being corrected and production records are soon expected to become universally available.

Water produced ranges from 4 to 15 percent higher than water delivered. A loss of 10 percent or less appears to be acceptable to most agencies even though occasionally, a system with a lower efficiency is encountered. The difference between production and delivery to customers is called "unaccountable water", or "loss in the system", and may be caused by one or more of the following factors:

-Flushing of sewers and hydrants.
-Free water delivery to "public facilities".
-Back-flushing of filter equipment.
-Hydrant tapping for use of water on construction jobs.
-Defective or slow recording meters.
-Leakage in the system
-Storage evaporation.
-Fire fighting and other unmeasured use.
-Unreported data for some meters in system.

These losses can be determined, isolated, and possibly reduced only by accurate measurement of both production and delivery. Where total production values were not available, they were obtained by increasing total delivery values by 10 percent.

Unreported Water Use - In computing unit water use for a community, use of agency data alone will result consistently in low values, since more water is produced and used than is recorded. Most of this unrecorded water originates from private wells in manufacturing plants, in commercial enterprises, and on residential property. An example of the quantity of such supplemental water sources is presented below for four cities in the San Joaquin Valley*.

AVERAGE PER CAPITA WATER USE FOR SEVERAL CITIES

City	Year	From Public Water Supplies	From Known Private Supplies
Bakersfield	1959	297 gallons/day	10 gallons/day
Fresno	1956	317 gallons/day	102 gallons/day
Hanford	1959	249 gallons/day	66 gallons/day
Visalia	1959	261 gallons/day	50 gallons/day

* Data obtained from an unpublished Department report titled, "Urban Water Use in Five San Joaquin Valley Cities", March 1960

Normally, private water producers for residential and commercial uses follow the same general patterns of use as their counterparts served by water agencies. If they are located outside a water agency service area, the omission of their water use will have a negligible effect on per capita values. If they occur within such a boundary, they can increase per capita use. Unfortunately, no data is available on the number of such producers or the quantity of water they produce. Since few residential users can produce water as economically as it can be purchased, the additive effect of this component on per capita use is considered negligible. On the other hand, some commercial establishments have found it more economical to develop their own water. The addition of high-water-using commercial producers such as laundries or car washes could result in an increased per capita use. The influence of this condition would be felt more strongly in smaller communities. The importance of the contribution of these private producers will be investigated in future studies.

High-water-using comercial establishments producing their own water can increase per capita use in small communities.

Generally, the private industry-produced increment of unreported water is the largest. Its addition to annual agency-produced water can more than double the per capita use. Obtaining an estimate of the quantity of this source of water is difficult because many producers fail to keep records or to provide reasonable estimates. Nevertheless, much useful data were collected in a 1957-59 statewide survey of industrial water use, reported in Bulletin No. 124. For example, the report indicates that 1,630 manufacturing establishments within an area including the north half of the Central Coastal, all of the San Francisco Bay, and the southern panhandle of the North Coastal Hydrographic Areas used 148,700 acre-feet of fresh water, of which 80,900 acre-feet, or 54 percent, was produced by private company systems. Although, no absolute percentage values can be given of the contribution of private industry-produced fresh water to total use, per capita values representing most of the industrial use are reported in Chapter III by county and hydrographic areas.

No data are available to estimate quantities of water which are developed privately by commercial enterprises or at urban and suburban residences. On a statewide basis, the contribution of these private sources is believed to be small. At the local level, however, the contribution could be appreciable, especially where water tables are high and where pumping water is cheaper than purchasing it.

Population Served - Determining accurately the population served by a water agency is a task as important and as difficult as determining accurately the amount of water produced. Boundaries of water service areas seldom coincide with the boundaries of cities or census areas. A water agency occasionally serves only a portion of a city or serves customers beyond the city limits. In a larger city, the remaining area may be served by one or more small agencies. Early computations of per capita use under these conditions were frequently unrealistically low because the water served by the smaller agencies was not included in the computations although the population served by the smaller agencies was included. To overcome these problems and to obtain more realistic population values, various techniques were used in this report. The techniques used are discussed in Appendix B.

Miscellaneous - Other factors which can be expected to influence M&I water use are worn flow meters and inadequate distribution systems. These conditions would tend to lower per capita use values. An increase in the ratio of population to number of high-water-using industries tends to decrease the unit values of water use.

CHAPTER III. URBAN PER CAPITA WATER USE

In this chapter are presented the results of an inventory and analysis of per capita water use in the major population centers of the State.

Considerations in Using Results

The effective use of the per capita values presented herein requires familiarity with the background material in Chapter I and an understanding of the various factors affecting M&I water use discussed in Chapter II. The user will also find the items discussed below of some additional value in clarifying the extent to which the per capita values can be used.

Data Accuracy

In developing per capita water use values for this report, most of the water production measurements and estimates used were made by personnel of water agencies and private manufacturing establishments. As a result, it has not been possible to verify the water production values or even to evaluate the physical state of individual water systems; i.e., their line losses, the accuracy of their meters, the care used in recording the information, etc. The population component, on the other hand, was frequently estimated by personnel of the Department. Because estimates were obtained through interpolation, extrapolation, or the use of a factor, the accuracy of the results could be no better than the base data on which they were estimated and the techniques required to compute them. As a result, the overall degree of reliability maintained in developing the urban per capita water use values is subject to great variation. However, where there have been clear indications of questionable data, such data has either been strengthened or discarded.

Data from commercial water agencies on population and water use reported to the State Public Utilities Commission are generally quite reliable. However, frequent checks among the numerous public water service agencies disclosed that water use estimates were not always made with the same level of accuracy or detail.

Average Values

Prior to developing five-year average urban per capita water use values, consideration was given to developing long-term averages. A number of factors discouraged this approach.

To use the classical method of statistics whereby extrapolation or estimation of future values can be made as far into the future as records extended into the past, historical annual per capita water use would have to change uniformally with time.

Analyses of unit water use data covering the past 50 years reveals these values to be extremely erratic with respect to time and fail to disclose any definite trend which can be assumed to be repeated in the future with a high degree of reliability. Known factors abetting these erratic variations over the past 50 years include two great wars, two smaller wars, a depression, widespread use of automobiles and planes, mass westward migration of population and an ever-increasingly affluent society. While similar historic events may recur within the next 50 years, just how, when, and to what degree is very nebulous. Time has not permitted additional detailed analyses of causes for individual annual variations nor has it permitted analyses of the relationships between the major factors involved in developing unit water use values.

Not only have long-term trends been interrupted, they have been stopped or reversed in certain cases. This has occured in manufacturing, where technology has found ways of conserving and reusing water or has reduced the dependency of a particular process on water. In many urban areas, population densities have increased and greenery has decreased. The result is lower per capita water use.

Because current trends are often so dissimilar from long-term trends, it is believed to be rather hazardous to use data that go very far back in time. Planners need values which will represent future use. Because of this need and the greater availability of recent data, the most current five years of record was selected as the base period for developing urban unit water use values. Wherever possible, the period 1961-65 was used.

In some instances, it was either impractical or impossible to develop a complete five-year record for each city studied. In these cases, all the data covering any portion of the period 1958-1967 were used in the report. The fact that the same five-year period was not always used in developing the averages is not believed to be significant. The reason is that an adequate number of common years exists in each average to limit variation.

In a few cities, annual values were available for more years than were monthly values. In these cases an average was developed for the annual values separately from the monthly values. Examples where two averages are shown are for the city of San Bruno, Table 3b, page 42. Except for Crescent City in the North Coastal Hydrographic Area, at least two years of record were available for each city.

As can be seen from the table below, data were generally less abundant and less complete in low-density areas of the State.

Relationship Between Population Distribution and Extent of Sampling

Hydrographic Area	Average 1960-65 Population	Percent of State Total	Percent of Population Sampled
South Lahontan	195,000	1.1	4
Colorado River Basin	199,000	1.1	15
North Coastal	253,000	1.4	43
San Joaquin River Basin	374,000	2.2	26
Delta-Central Sierra Basin	378,500	2.2	28
Central Coastal	640,000	3.7	43
Tulare Lake Basin	884,500	5.1	42
Sacramento River Basin	1,030,500	6.0	35
San Francisco Bay	3,820,000	22.3	79
South Coastal	9,413,000	54.8	52

Periods of Peak and Low Water Use

Examination of yearly data in Appendix C shows that periods of peak and low water use are not always in the same month. Also, there is not always a definite upward trend to peak use or a downward trend from peak to low use. Interruption of such trends may be due to rainfall, unusual temperature conditions, water-system flushing, once-a-year special uses of water such as for food processing, or a number of other reasons. Whenever possible, attempts have been made to determine the reasons for such interruptions. In many instances, a brief examination of the data reveals no apparent reason. An in-depth examination of data to explain such variables has not yet been attempted. However, this will be considered in future work.

Results and Discussion

Five-year averages of daily per capita water use by month and year were developed from water-agency data, and three-year averages of daily per capita use of fresh and brackish water by year were developed from data of manufacturing establishments producing their own water.

Agency-Produced Water

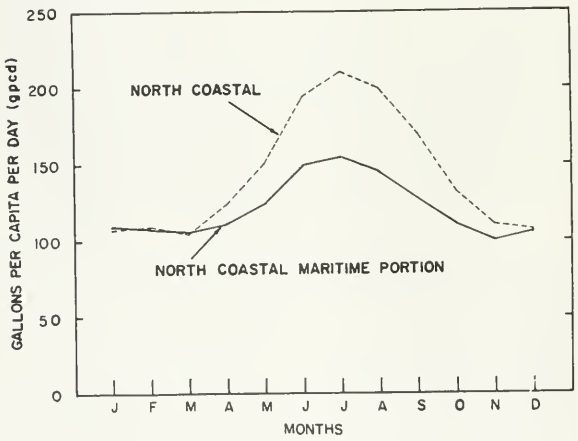
Daily per capita water use was averaged by month and year, by hydrographic areas, by counties, and by cities.

Hydrographic Areas - Per capita water use within the hydrographic areas is presented in Table 1 and charted in Figure 6. They were obtained by weighting the average per capita values of each city within the hydrographic area according to its population.

As can be seen, the North Coastal HA* has the lowest per capita water use (excluding the water used by the pulp industry)**, while the Tulare Lake Basin and San Joaquin River Basin areas have the highest. The maritime portion of the North Coastal HA (north of Fort Bragg) shows very little fluctuation from winter to summer, an indication that very little water other than rainfall is needed to sustain vegetative growth. These results are shown on Figure 7.

Figure 7

COMPARISON OF PER CAPITA WATER USE
IN TWO AREAS OF THE NORTH COASTAL
HYDROGRAPHIC AREA



* Hydrographic Area

** In 1966, the water used by the pulp industry amounted to 66,100 acre-feet, an amount of water equal to 538 gpcd when related to the average population served during 1965 in the seven cities of the hydrographic area examined.

TABLE 1

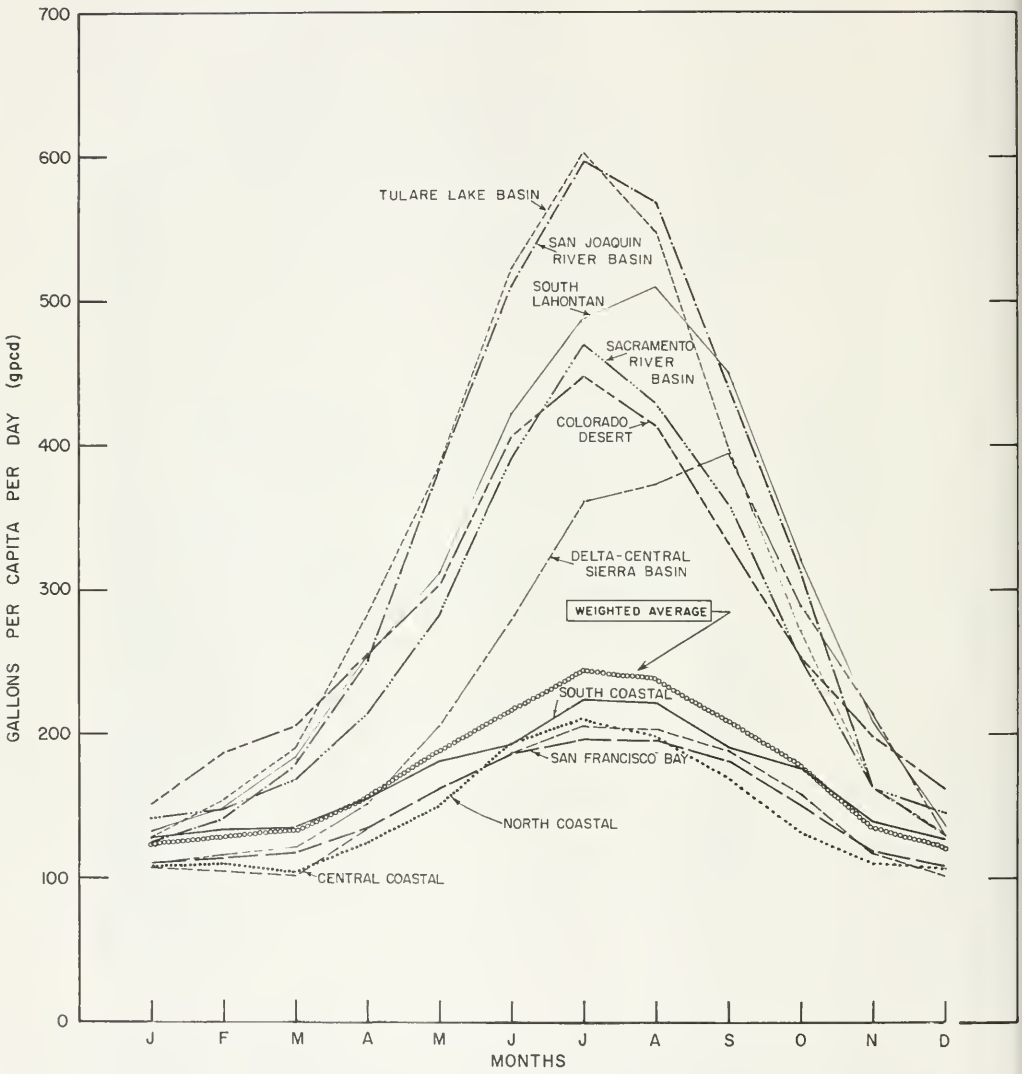
AVERAGE MONTHLY AND ANNUAL URBAN UNIT WATER USE
AGENCY-PRODUCED WATER
(1961-1965) 1/

Hydrographic Areas

Hydrographic Area		Average Estimated Population of Area 2/	Average Estimated Population Served 2/	% of Total Pop. Served	Unit	Average Daily Water Use												Total
						Monthly (gpcd) 3/												Annually
Code	Name					Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	gpcd	afpcy 4/
NC	North Coastal 5/	218,600	109,800	50	gpcd	107	109	104	124	151	194	211	199	170	133	110	107	143	.160
					% Annual 6/	6.3	5.8	6.2	7.1	8.9	11.1	12.5	11.8	9.7	7.9	6.3	6.3		
SF	San Francisco Bay	3,824,300	2,999,700	78	gpcd	110	113	117	134	161	186	196	195	181	151	118	108	146	.160
					% Annual	6.3	5.9	6.7	7.5	9.3	10.3	11.3	11.2	10.1	8.7	6.6	6.2		
CC	Central Coastal	640,000	277,700	43	gpcd	107	104	101	134	161	186	205	203	187	158	117	101	148	.166
					% Annual	6.2	5.4	5.8	7.8	7.5	9.3	11.8	11.7	10.4	9.1	6.5	5.8		
SC	South Coastal	9,413,000	4,907,800	52	gpcd	127	134	135	154	181	193	224	222	191	176	139	127	167	.187
					% Annual	6.5	6.1	6.9	7.6	9.2	9.5	11.4	11.3	9.4	8.9	6.8	6.5		
SB	Sacramento River Basin	890,800	358,700	40	gpcd	141	147	168	214	282	390	468	428	359	252	162	145	263	.294
					% Annual	4.5	4.3	5.4	6.7	9.1	12.2	15.1	13.8	11.2	8.1	5.0	4.7		
DC	Delta-Central Sierra Basin	348,550	104,700	30	gpcd	109	115	121	152	205	278	361	373	394	288	214	129	227	.254
					% Annual	4.0	3.9	4.5	5.5	7.6	10.0	13.4	13.8	14.2	10.7	7.7	4.8		
SJ	San Joaquin River Basin	349,200	96,800	28	gpcd	126	142	177	251	384	510	598	568	442	312	163	130	317	.355
					% Annual	3.3	3.4	4.7	6.5	10.3	13.2	16.0	15.2	11.4	8.3	4.2	3.5		
TB	Tulare Lake Basin	884,500	367,700	42	gpcd	127	154	190	282	385	521	602	548	397	271	163	129	314	.352
					% Annual	3.4	3.7	5.1	7.4	10.4	13.6	16.2	14.8	10.4	7.3	4.3	3.5		
SL	South Lahontan	179,000	8,300	5	gpcd	132	148	183	254	312	422	487	509	450	321	209	136	298	.334
					% Annual	3.8	3.8	5.2	7.0	8.9	11.6	13.9	14.5	12.4	9.2	5.8	3.9		
CD	Colorado Desert	199,300	30,600	15	gpcd	151	187	205	255	303	406	448	414	333	253	199	152	277	.310
					% Annual	4.6	5.2	6.3	7.6	9.3	12.1	13.7	12.7	9.9	7.8	5.9	5.0		
	SUMMARY	16,947,250	9,261,800	55	gpcd	123	127	136	155	189	216	244	238	208	177	134	121	172	.193
					% Annual	6.1	5.7	6.5	7.4	9.3	10.3	12.0	11.7	9.9	8.7	6.4	6.0		

1/ Base period. Variations in period and years of record exist for individual cities. Refer to Table 3.
2/ Developed from Table 2. Population of Area values for portions of divided counties determined by Department of Water Resources. They include only those counties for which agency-produced data were obtained.
3/ All values weighted by populations of counties served.
4/ afpcy-acre feet per capita per year.
5/ Does not include water used by the pulp industry in the Eureka-Arcata area. In 1966, the water used by this industry amounted to 66,100 acre-feet, an amount of water equal to 538 gpcd when related to the average population served during 1965 in the seven cities of the hydrographic area examined.
6/ % Annual = $\frac{\text{monthly gpcd x days in month}}{\Sigma \text{ monthly gpcd x days in month}} \times 100$

AVERAGE MONTHLY PER CAPITA WATER USE
AGENCY PRODUCED FRESH WATER
HYDROGRAPHIC AREAS



Although the occurrence of the lowest values in the North Coastal area is not surprising, the occurrence of the highest values in the San Joaquin River Basin is. From the higher temperatures and lower rainfall in the Colorado Desert Area and South Lahontan HA's, it would be expected that the highest value would occur there. Although the reason for this departure from expected results is not fully known, probably less external water is used in these two areas because of the small lawn and garden areas and often sparse vegetation.

Figure 6 also shows that per capita water use in the Central Coastal Area is similar to the use in the San Francisco Bay and North Coastal areas and only slightly lower than in the South Coastal area. The reason for the similarity appears to be related to the uniform climatic conditions that prevail along the coast.

Especially noticeable on the graph is the great contrast between values for the coastal areas and values for the desert and central valley areas. If it were not for the number of inland coastal valleys included in the analyses for the coastal areas, the contrast would have been even more pronounced, as exemplified by the curves for the total coastal portion of the North Coastal Area and the maritime portion of the North Coastal Area.

The high per capita use in the Colorado Desert Area during the winter is principally due to mild temperature and low rainfall in the low desert areas where the sampled cities were located, which sustain year-round leisure-recreational activities and require continued watering of lawns and ornamental shrubbery.

The weighted statewide monthly use, depicted by the wide line, shows that the higher-populated areas with their lower unit water use have more influence on the statewide pattern than do the lower-populated, higher-unit-water-use areas. However, the latter areas will play an increasingly important role in shaping the future statewide pattern of use as the major coastal population centers reach saturation and urban expansion accelerates inland.

Counties - Table 2 shows per capita urban water use values by county. The counties of Alpine, Calaveras, Colusa, Inyo, Lassen, Mariposa, Modoc, Mono, Nevada, Plumas, Sierra, Siskiyou, Trinity, Tuolumne, and Yolo are not included because data were not obtained for any communities within their boundaries. The value for Humboldt County does not include the water supplied by Humboldt Bay Municipal Water District for use by the pulp industry in the Eureka-Arcata area. In 1966, this was 66,100 acre-feet and, when related to the average population of cities examined in the county, equals 1,224 gpcd.

The monthly urban per capita water use values were determined from data on water supplied only through water agencies. The

TABLE 2

AVERAGE MONTHLY AND ANNUAL URBAN UNIT WATER USE
AGENCY-PRODUCED WATER
(1961-1965) 1/

Counties

County 2/	Average Estimated Population of County 3/	Average Estimated Population Served 4/	Percent of Total Population Served	Average Daily Water Use												TOTAL
				Monthly (gpcd)												Annually
				Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	gpcd	afpcy 6/
Alameda	970,400	939,367 5/	97	119	122	127	148	174	197	207	208	193	163	128	117	158	.177
Amador	10,800	3,343	31	208	250	209	208	271	318	389	423	471	393	348	305	316	.354
Butte	90,100	44,491	49	125	127	150	256	352	588	694	660	483	259	145	122	330	.370
Contra Costa	459,300	294,058	64	119	122	127	149	178	204	215	223	211	175	131	120	162	.181
Del Norte	18,050	5,000	28	165	143	106	133	151	158	150	157	147	112	87	147	138	.155
Fresno	387,050	173,876	45	123	147	178	288	385	525	619	566	415	280	172	132	319	.357
Glenn	18,000	4,825	27	120	125	135	223	303	524	555	480	363	224	136	118	272	.305
Humboldt 7/	105,050	48,200	46	107	108	109	113	125	151	158	147	128	115	103	105	122	.137
Imperial	74,550	18,640	25	145	176	193	230	290	354	382	347	293	241	172	146	247	.277
Kern	311,300	131,977	42	139	173	214	293	401	534	609	557	399	281	165	133	325	.364
Kings	58,500	18,112	31	111	133	178	246	352	457	503	455	326	234	134	108	270	.302
Lake	15,500	5,174 5/	33	90	90	102	131	195	279	322	294	231	178	108	94	151	.169
Los Angeles	6,453,550	3,544,596	55	139	140	141	159	186	196	228	225	194	179	143	133	172	.193
Madera	42,400	15,300	36	149	174	214	265	453	582	681	625	450	312	166	143	351	.393
Marin	167,700	161,522	96	97	101	105	127	166	203	216	209	187	156	114	97	148	.166
Mendocino	51,150	15,163	30	100	101	103	128	170	262	298	273	217	146	105	104	167	.187
Merced	98,750	39,200	40	114	127	161	227	355	478	565	514	371	264	144	117	287	.321
Monterey	209,950	128,035	61	88	86	88	108	138	166	171	166	156	131	101	83	123	.138
Napa	70,800	42,820	60	127	130	135	135	189	232	248	255	236	193	131	121	178	.199
Orange	928,100	316,300	34	132	140	140	168	203	224	252	257	221	199	148	132	185	.207
Placer	60,900	11,723	19	151	153	137	154	203	316	489	658	515	374	241	166	287	.322
Riverside	359,700	121,300	34	149	163	165	217	262	317	375	354	287	229	188	151	238	.267
Sacramento	557,350	261,900	47	144	151	169	211	279	357	425	380	333	249	162	149	251	.281
San Benito	16,300	7,182 5/	44	98	97	106	124	148	172	194	196	232	203	98	94	148	.166
San Bernardino	570,400	104,479	18	133	144	141	189	236	288	358	344	275	226	156	131	219	.245
San Diego	1,115,100	793,179	71	98	101	101	116	136	143	161	165	147	138	100	97	126	.141
San Francisco	745,000	745,000	100	114	114	116	123	131	141	137	135	134	125	115	110	125	.141
San Joaquin	261,800	88,869	34	109	113	121	153	203	279	368	380	410	294	218	125	230	.258
San Luis Obispo	90,750	30,609	34	122	131	132	169	212	247	278	270	236	196	145	123	188	.211
San Mateo	485,650	208,631 5/	43	86	92	92	109	126	156	164	161	154	128	106	89	124	.138
Santa Barbara	206,000	64,560	31	136	130	146	161	186	191	222	225	198	170	127	122	168	.188
Santa Clara	768,050	613,567 5/	80	97	103	112	128	177	213	237	231	209	160	106	96	157	.175
Santa Cruz	94,500	38,631	41	112	103	111	144	144	184	209	228	217	189	137	115	157	.176
Shasta	67,100	15,315	23	133	135	152	186	243	381	485	428	330	224	150	134	250	.280
Solano	147,200	12,519	8	84	91	94	131	201	262	303	308	264	220	154	111	185	.207
Sonoma	163,450	45,188	28	102	108	100	133	178	225	248	240	206	155	124	105	160	.179
Stanislaus	166,650	42,300	25	128	143	179	268	385	513	598	597	506	355	179	138	232	.372
Sutter	36,200	2,276	6	89	85	100	176	283	403	462	409	312	176	131	98	227	.254
Tehama	26,800	3,071	12	187	171	184	227	258	427	489	468	356	275	203	201	287	.321
Tulare	177,800	43,716	24	111	128	168	236	350	491	555	488	348	220	138	110	278	.311
Ventura	250,900	47,850	19	121	117	112	150	173	170	173	200	239	183	138	117	158	.177
Yuba	38,650	9,936	26	162	168	160	232	280	428	519	477	357	261	185	166	283	.317
SUMMARY	16,947,350	9,261,800	55	123	127	136	155	189	216	244	238	208	177	134	121	172	.193

1/ Base period. Variations in period and years of record exist for individual cities. Refer to Table 3.

2/ Includes only those counties for which agency produced data were obtained.

3/ Population of County--average of 1960 and 1965 DWR estimates; Population Served--sum of average population estimates for individual cities.

4/ All values weighted by populations of cities served.

5/ Annual values for — Alameda : Lake : San Benito : San Mateo : Santa Clara : counties were based on the following populations: 923,583 : 4,774 : 6,651 : 206,502 : 613,386 :

The populations differ because in certain communities more years of data were available for determining average annual values than average monthly values.

6/ afpcy - acre feet per capita per year.

7/ Does not include water used by pulp industry in the Eureka-Arcata area. In 1966, the amount of water used by this industry amounted to 66,100 acre-feet, an amount of water equal to 1,224 gpcd when related to the average population of cities examined in the county.

addition of fresh and brackish water produced by manufacturing concerns would influence the unit use value immensely and would create patterns of use very different from those shown on Figure 6 for some areas of the State, especially for the North Coastal Area. Monthly data from these other sources were not obtained for this report, but collecting such data is a future goal.

Cities - The cities studied are discussed below by hydrographic area. Where possible, unusual monthly patterns of water use and unusual maintenance and operation practices are described. The locations of the cities are shown on Figure 3. Yearly data for these cities are presented in Appendix C.

(North Coastal HA) - The average monthly and annual per capita values for the seven cities sampled in the North Coastal Hydrographic Area are summarized in Table 3a.

TABLE 3a
AVERAGE MONTHLY AND ANNUAL URBAN UNIT WATER USE
AGENCY PRODUCED WATER
CITIES

NORTH COASTAL
Hydrographic Area

County City	Agency * (Name and Type)	Period of Record	Yrs. of Rec.	Avg. Annual Water Into System (million gals.)	Average Estimated Population Served	Highest Monthly Use (gpcd)	Average Daily Water Use Monthly (gpcd) Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total Annually gpcd	afpcy
DEL NORTE																				
Crescent City	- M.W.D.	1966	1	252	5,000	-	165	143	106	133	151	158	150	157	147	112	87	147	**	**
HUMBOLDT																				
Arcata	- M.W.D.	1964-66	3	350	9,300	130	92	90	94	97	116	115	118	114	111	103	96	91	103	.115
Eureka	- M.W.D. & Humboldt C.S.D.	1963-66	4	1,766	37,800	187	112	113	114	118	129	161	168	155	132	119	106	110	128	.143
Garberville	Garberville Water Company, Inc. (C.W.C.)	1962-64	3	39	1,100	167	70	77	68	77	84	130	158	151	120	86	75	67	97	.109
MENDOCINO																				
Fort Bragg	- M.W.D.	1961-65	5	198	5,320	157	82	85	84	90	106	136	143	131	115	92	83	83	102	.114
Ukiah	- M.W.D.	1961-65	5	726	9,843	402	110	110	113	149	205	330	381	350	272	175	117	115	202	.226
SONOMA																				
Santa Rosa	- M.W.D.	1961-65	5	2,403	41,411	265	103	109	99	134	174	223	247	237	204	152	123	106	159	.178

* The following abbreviations are used throughout Table 3 to denote the type of agency:

C.S.D. - Community Services District
C.W.C. - Commercial Water Company
C.W.D. - County Water District
C.W.W.D. - County Waterworks District
I.D. - Irrigation District
M.U.D. - Municipal Utility District
M.W.D. - Municipal Water Department
U.M.W.C. - Unincorporated Mutual Water Company

** In 1966, average daily water use was 138 gpc and total annual use was 0.154 afpc.

A considerable portion of the North Coastal area is outside the coastal environment, as shown in Figure 3. However, approximately 90 percent of the area's total population inhabit the coast. The remaining ten percent live primarily in Scott and Shasta Valleys of Siskiyou County. Crescent City and Eureka, which have a sizable lumber and wood products industry, have higher per capita water use than the other coastal cities*. In Garberville and Fort Bragg monthly per capita water use increases sharply in June and remains high until sometime during September. The sharp increase results from adding the water used by the recreation-seeking transient population to the resident population. This method of arriving at per capita water use was necessary because firm data on transient population was not available for this report. This method is used in other areas influenced by recreational use.

Four of the five northernmost cities not only have low per capita water use, but their winter use is nearly constant. This relatively stable condition is due, in large measure, to the moderately cool moist climate requiring very little external use. Another factor damping seasonal fluctuations is the high, constant monthly use of water by the lumber and wood products industry.

Compared with the five cities discussed above, water use in Ukiah and Santa Rosa is quite high. Climate explains most of the difference, since the latter communities are more inland.

(San Francisco Bay HA) - As in the North Coastal HA, per capita water use in the San Francisco Bay HA is influenced by the coastal environment. Average monthly and/or annual unit urban water use values for the 26 cities and 5 multiple city and community service agencies sampled in San Francisco Bay area are summarized in Table 3b.

The weighted average per capita values developed for the area were based on data from the total East Bay Municipal Utility District and 23 other agencies. These 24 entities comprise about 17 percent of the State's total population and approximately 79 percent of the total population within the area. The East Bay Municipal Utility District, alone, serves almost 27 percent of the area's total population.

Per capita use averages higher than in the North Coastal HA for two principal reasons: The San Francisco Bay HA has more communities in coastal valleys, which use more water per capita than cities immediately along the coast; and the area has many high-water-using industries, such as food

* Pulp industry water use is not included in these values or those for the other cities. Refer to discussion on Page 34.

SAN FRANCISCO BAY
Hydrographic Area

TABLE 3b
AVERAGE MONTHLY AND ANNUAL URBAN UNIT WATER USE
AGENCY PRODUCED WATER
CITIES

County City	Agency* (Name and Type)	Period of Record	Yrs. of Rec	Avg. Annual Water Into System (million gals.)	Average Estimated Population Served	Highest Monthly Use (gpcd)	Average Daily Water Use Monthly (gpcd)												Total Annually	
							Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	gpcd	afpcy
ALAMEDA																				
Alameda	East Bay M.U.D.	1961-65	5	2,918	67,173	-	-	-	-	-	-	-	-	-	-	-	-	-	119	.133
Berkeley	East Bay M.U.D.	1961-65	5	5,870	114,800	-	-	-	-	-	-	-	-	-	-	-	-	-	140	.157
Livermore	Cal. Water Service Co. (C.W.C.)	1961-65	5	1,110	22,517	243	77	83	85	121	154	202	227	203	184	126	92	73	135	.151
Oakland	East Bay M.U.D.	1961-65	5	18,059	374,819	-	-	-	-	-	-	-	-	-	-	-	-	-	132	.149
Pleasanton	Pleasanton Township (C.W.D.)	1964-66	3	477	6,658	286	95	104	119	155	211	241	271	267	237	213	125	118	180	.202
San Leandro	East Bay M.U.D.	1961-65	5	3,814	67,417	-	-	-	-	-	-	-	-	-	-	-	-	-	155	.171
San Ramon Village	Valley C.S.D.	1962-65	4	114	1,810	207	66	73	67	90	129	157	180	161	142	117	74	66	110	.123
S. E. Bay Area	Alameda C.W.D.	1962-66	5	4,355	90,398	-	-	-	-	-	-	-	-	-	-	-	-	-	132	.147
S. E. Bay Area	Alameda C.W.D.	1966	1	5,581	106,182	207	95	98	111	155	191	207	190	191	170	144	95	86	144	.161
CONTRA COSTA																				
Antioch	- M.W.D.	1962-65	4	1,374	20,454	349	90	96	106	154	219	254	241	292	330	229	104	96	184	.206
Martinez	- M.W.D.	1962-66	5	944	15,832	247	96	91	103	147	195	223	219	275	263	218	113	108	172	.193
Pittsburg	- M.W.D.	1961-65	5	916	19,952	220	90	88	92	120	145	175	201	196	166	135	105	89	134	.150
Richmond	East Bay M.U.D.	1961-65	5	10,187	76,091	-	-	-	-	-	-	-	-	-	-	-	-	-	367	.411
Walnut Creek	East Bay M.U.D.	1961-65	5	893	13,079	-	-	-	-	-	-	-	-	-	-	-	-	-	187	.209
MARIN																				
North Marin Cities	North Marin C.W.D.	1961-65	5	945	29,522	265	66	72	74	103	143	182	202	201	164	122	82	72	124	.139
South Marin Cities	Marin M.W.D.	1961-65	5	7,720	141,000	232	101	105	110	131	169	200	218	210	190	149	111	101	150	.168
MENDOCINO																				
Ukiah	- M.W.D.	1961-65	5	784	9,841	402	110	110	111	149	205	310	381	350	272	175	117	115	202	.226
NAPA																				
Calistoga	- M.W.D.	1961-65	5	151	1,914	590	158	174	303	183	194	256	305	287	241	182	156	150	216	.242
Napa	- M.W.D.	1964-66	2	2,628	40,000	259	126	128	127	13	188	231	245	254	236	193	130	120	176	.197
SAN FRANCISCO																				
San Francisco	- M.W.D.	1961-65	5	13,913	345,000	131	114	114	116	12	131	141	137	135	134	125	115	110	125	.140
SANTA CLARA																				
Mountain View	- M.W.D.	1961-65	5	1,446	40,200	186	91	94	10	12	152	174	185	179	162	136	108	97	134	.150
Palo Alto	- M.W.D.	1961-65	5	4,348	57,548	309	127	148	142	170	205	262	302	294	286	232	176	13	207	.232
San Jose	San Jose Water Works (C.W.C.)	1963-65	3	24,235	428,364	159	94	99	109	124	178	214	238	231	208	156	99	92	155	.174
Sunnyvale	- M.W.D.	1963-65	3	4,008	78,425	215	92	99	109	117	160	188	202	206	182	139	93	91	140	.157

* Refer to Table 3a for abbreviations (page 39).

SAN FRANCISCO BAY (cont'd)
Hydrographic Area

TABLE 3b
AVERAGE MONTHLY AND ANNUAL URBAN UNIT WATER USE
AGENCY PRODUCED WATER
CITIES

County City	Agency* (Name and Type)	Period of Record	Yrs. of Rec.	Avg. Annual Water Into System (million gals.)	Average Estimated Population Served	Highest Monthly Use (gpcd)	Average Daily Water Use Monthly (gpcd)												Total Annually	
							Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	gpcd	afpcy
SAN MATEO																				
Belmont	Belmont C.W.D.	1961-65	5	897	20,300	197	89	95	99	117	138	168	159	152	142	111	93	88	121	.136
Half Moon Bay Cities	Coastside C.W.D.	1962-65	4	159	4,774	117	72	86	68	88	94	92	96	106	108	102	102	76	91	.102
Pacifica	North Coast C.W.D.	1961-65	5	883	26,573	148	65	73	68	74	82	106	126	118	115	101	90	72	91	.102
Redwood City	- M.W.D.	1961-65	5	2,252	50,168	177	82	94	90	105	128	159	167	169	163	133	103	88	123	.138
San Bruno	- M.W.D.	1961-65	5	1,531	32,759	-	-	-	-	-	-	-	-	-	-	-	-	-	128	.143
San Bruno	- M.W.D.	1964-65	2	1,420	34,888	146	91	92	94	106	110	136	139	146	145	136	120	94	117	.131
San Mateo	Cal. Water Service Co. (C.W.C.)	1961-65	5	3,587	71,928	204	95	98	100	125	147	184	195	185	172	136	110	95	137	.153
SONOMA																				
Sonoma	- M.W.D.	(1964-65) - (1966-67)	3	238	3,777	300	97	102	106	124	226	242	260	273	229	183	137	98	173	.194
Entire East Bay M.U.D. System	East Bay M.U.D.	1961-65	5	61,140	1,034,000	222	124	127	131	148	173	196	209	211	196	167	134	123	162	.181

* Refer to Table 3e for abbreviations (page 39).

processing, chemical, and petroleum industries. The high-water-using industries probably account for the high overall per capita use within the service area of the East Bay Municipal Utility District, which serves many such establishments.

Lower rainfall and higher temperatures also contribute to higher use because of greater outside use. Higher temperatures also increase internal use during the summer, particularly in the eastern portion of the study area and in the southern portions of the Santa Clara Valley, where a few evaporative coolers are still used. Also, the residential areas typically are being built on larger lots with more extensive shrubbery and lawns than in the residential areas in the North Coastal Area, where the peak summer use varies considerably among the communities. Although the scope of the studies has not permitted a thorough investigation of the reasons for different peaking months, some information is available on a few of the communities.

In the city of Antioch, the occurrence of the peak use in September is caused by a single cannery, which processes tomatoes during that month and uses between 30 and 40 percent of the city's water. In the city of Pittsburg, just four miles to the west, peaking occurs in July and in the city of Martinez, 15 miles further west, the peaking occurs in August. This variation is due to different industrial needs and the greater influence of residential outside water use. In the city of Calistoga, the peak use usually occurs in July, but may occur in March. This happens because, when the water department flushes out the system lines, it does so in March. This was done in two of the last five years.

(Central Coastal HA) - The Central Coastal HA contains approximately 4 percent of the State's total population. Of this, approximately 43 percent was included in the cities sampled. Average monthly and annual values for the six cities and two multiple city and community service agencies sampled in the Central Coastal Area are presented in Table 3c.

The two multiple city water agencies, California Water Service Company and California American Water Company, gave service to a total of seven cities for which data are included.

In the Central Coastal HA, per capita water use of the inland cities of Kings City, Hollister, Paso Robles, and Gilroy is higher during the summer growing season months than those cities along the coast. During the winter, these cities have lower temperatures than cities bordering the coast and are more subject to foggy weather, which tends to reduce outside water use.

TABLE 3c
AVERAGE MONTHLY AND ANNUAL URBAN UNIT WATER USE
AGENCY PRODUCED WATER

CENTRAL COASTAL
Hydrographic Area

CITIES

County City	Agency* (Name and Type)	Period of Record	Yrs. of Rec.	Avg. Annual Water Into System million gals	Average Estimated Population Served	Highest Monthly Use (gpcd)	Average Daily Water Use Monthly (gpcd) Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total Annually gpcd	afpcy
MONTEREY																				
Carmel	Cal. American Water Co. (C.W.C.)	1959-63	5	363	6,995	-	102	-	108	-	152	-	184	-	180	-	126	-	142	.159
King City	Cal. Water Service Co. (C.W.C.)	1962-65	4	271	3,003	421	124	140	156	213	271	339	361	379	361	278	196	153	247	.277
Monterey	Cal. American Water Co. (C.W.C.)	1959-63	5	900	21,829	-	86	-	82	-	111	-	141	-	149	-	111	-	113	.127
Monterey Bay Cities	Cal. American Water Co. (C.W.C.)	1961-65	5	3,561	89,500	159	82	77	81	102	126	148	151	145	133	113	83	70	109	.122
Pacific Grove	Cal. American Water Co. (C.W.C.)	1959-63	5	452	12,258	-	74	-	70	-	100	-	135	-	133	-	96	-	101	.114
Salinas	P. G. & E (1961)- Cal. Water Service Co. (C.W.C.)	1963-65	3	1,932	35,532	234	100	103	101	116	156	195	205	199	198	165	137	109	149	.167
Seaside	Cal. American Water Co. (C.W.C.)	1959-63	5	349	10,855	-	62	-	72	-	100	-	116	-	102	-	75	-	88	.099
SAN BENITO																				
Hollister	- M.W.D.	**	5	359	6,651	-	-	-	-	-	-	-	-	-	-	-	-	-	148	.166
Hollister	- M.W.D.	1964-65	2	385	7,182	261	98	97	106	124	148	172	194	196	232	203	98	94	147	.164
SAN LUIS OBISPO																				
Paso Robles	- M.W.D.	1961-65	5	676	6,809	494	131	150	160	230	316	405	472	453	376	268	168	139	272	.305
San Luis Obispo	- M.W.D.	1961-65	5	1,425	23,800	240	120	125	124	152	182	202	222	218	196	175	139	119	164	.184
SANTA BARBARA																				
Santa Barbara	- M.W.D.	1961-65	5	3,959	64,560	245	136	130	146	161	186	191	222	225	198	170	127	122	168	.188
SANTA CLARA																				
Gilroy	- M.W.D.	***	5	543	8,848	-	-	-	-	-	-	-	-	-	-	-	-	-	168	.188
Gilroy	- M.W.D.	1963-65	3	570	9,030	309	93	100	146	133	209	264	301	260	217	169	98	89	173	.194
SANTA CRUZ																				
Santa Cruz	- M.W.D.	1961-65	5	2,214	38,631	259	112	103	111	144	144	184	209	228	217	189	137	115	157	.176

* Refer to Table 3a for abbreviations (page 39).

** 1960-61 through 1962-63 and 1964 through 1965. Six months of record missing in last half of 1963.

*** 1960-61 through 1961-62 and 1963 through 1965. Six months of record missing in last half of 1962.

Table 3c discloses that per capita water use in Monterey County cities varies considerably. For example, King City, approximately 50 miles south of Salinas, shows an annual per capita use of 247 gpcd, which is more than twice the annual value for Monterey Bay city residents. Climate in this case is the major factor for the higher King City value.

A slight difference has also been noted between the cities of Monterey and Carmel. The community of Carmel, with its larger estates, has low population densities and high external use of water, all of which add up to higher per capita water use.

Although only three years of records were available, Salinas, with a per capita use of 149 gpcd, appears to have the highest unit use of the coastal cities in Monterey County. This is partly due to a greater industrial base than in the other cities and partly due to high external water use.

Comparison of water use rates in Salinas, King City, and Paso Robles indicates that per capita use increases away from the coast. Paso Robles, about 100 miles south of Salinas, has a per capita use of 272 gpcd, which is primarily due to climate. The city has hot, dry summers and requires more water for external watering than the other two communities. Since Paso Robles has little industry, the high use is primarily a reflection of this application and illustrates the influence that residential watering can have on a community's per capita use.

An example of how industries influence the use of water is shown in the data for Hollister. The month in which peak use normally occurs in most communities in the Central Coastal HA is July. In Hollister, the peak use occurs in September when two canneries process tomatoes. In addition, spinach is washed and processed this month.

In the southern portion of the hydrographic area, water use values for San Luis Obispo and Santa Barbara further illustrate that per capita water use is quite constant along the coast. The average annual per capita water use for Santa Barbara, 168 gallons per day, is only four gallons per day higher than for San Luis Obispo.

In the Monterey Bay area, the coastal city with the highest per capita use is Santa Cruz, with 157 gpcd annually. This is surprising considering that it receives more rainfall and has lower temperatures than coastal cities farther south. A primary reason for the higher use is the large number of people attracted to the city's beach area on weekends and during the summer. Higher per capita use results because the water used by this group is added to that used by the resident population and the total is then converted to per capita use using only the resident population. Recreational use of the other communites, while large, is not as seasonal or as intense. This fact is substantiated by the highest average monthly use of 228 gpcd, a value considerably higher than the peak use in the other communities. Also accounting for some of the higher use is the large number of small family units of retired citizens living there.

(South Coastal HA) - The average monthly and annual values for the area's 18 cities and the California American Water Company serving three communities in the vicinity of Chula Vista, reported in Table 3d, account for the water used by 4,900,000 of the 9,400,000, or 52 percent, of the people

TABLE 3d
AVERAGE MONTHLY AND ANNUAL URBAN UNIT WATER USE
AGENCY PRODUCED WATER
CITIES

SOUTH COASTAL
Hydrographic Area

County City	Agency * (Name and Type)	Period of Record	Yrs. of Rec.	Avg. Annual Water Into System (million gals.)	Average Estimated Population Served	Highest Monthly Use (gpcd)	Average Daily Water Use Monthly (gpcd) Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total Annually gpcd	afpcy
LOS ANGELES																				
Beverley Hills	- M.W.D.	1961-65	5	4,104	39,869	443	237	263	244	273	303	326	345	347	300	293	235	226	282	.315
Burbank	- M.W.D.	1961-65	5	8,164	93,200	336	190	195	200	225	255	268	323	322	271	251	199	185	240	.269
Glendale	- M.W.D.	1961-65	5	7,347	125,800	250	123	121	127	145	176	181	230	224	184	164	128	113	160	.179
Long Beach	- M.W.D.	1961-65	5	17,626	357,700	184	108	110	111	126	150	157	174	176	153	139	112	102	135	.151
City Proper L.A. and Harbor	- M.W.D.	1961-65	5	102,601	1,801,918	195	136	137	138	146	167	170	187	187	166	163	139	132	156	.175
L.A. (San Fernando Valley)	- M.W.D.	1961-65	5	60,369	835,325	316	141	142	144	179	218	243	302	289	236	205	146	135	198	.222
Pasadena	- M.W.D.	1961-65	5	12,197	134,200	393	187	184	189	220	263	276	357	358	316	265	199	174	249	.279
Pomona	- M.W.D.	1961-65	5	5,300	77,653	294	134	137	134	162	200	218	273	268	237	209	142	132	187	.209
Santa Monica	- M.W.D.	1961-65	5	4,745	86,100	154	136	133	135	142	159	162	179	176	167	158	136	129	151	.169
ORANGE																				
Anaheim	-M.W.D.	1961-65	5	9,064	137,200	300	126	138	133	159	196	229	248	251	220	195	144	131	181	.203
Fullerton	- M.W.D.	1961-65	5	5,983	66,100	381	179	182	190	229	269	286	336	355	301	278	198	171	248	.278
Santa Ana	- M.W.D.	1961-65	5	6,310	113,000	221	113	119	119	142	174	183	207	208	174	158	123	111	153	.171
RIVERSIDE																				
Riverside	- M.W.D.	1961-65	5	9,136	109,300	384	148	158	159	208	255	298	356	336	275	224	182	147	229	.257
SAN BERNARDINO																				
San Bernardino	- M.W.D.	1961-65	5	7,644	96,200	366	133	144	138	184	229	277	347	330	260	218	151	131	212	.237
SAN DIEGO																				
Carlsbad	- M.W.D.	1961-65	5	1,832	11,100	577	186	176	229	235	389	391	465	468	395	339	215	162	304	.341
Chula Vista Area Cities	Cal. American water Co. (C.W.C.)	1961-64	4	3,759	105,100	134	74	81	72	79	96	109	132	127	125	116	101	81	98	.110
Escondido	- M.W.D.	1961-65	5	1,231	22,779	246	93	95	97	133	154	182	232	233	188	161	119	94	148	.166
Oceanside	- M.W.D.	1961-65	5	1,653	30,200	260	103	116	113	122	154	179	194	206	212	157	140	102	150	.168
San Diego	- M.W.D.	1961-65	5	28,698	624,000	172	100	103	103	119	137	141	160	162	142	136	106	98	126	.141
VENTURA																				
Oxnard	- M.W.D.	1961-65	5	2,760	47,850	287	121	117	112	150	173	170	173	200	239	183	138	117	158	.177

* Refer to Table 3a for abbreviations (page 39).

living in the South Coastal Hydrographic Area. The area contains approximately 55 percent of the State's population and even though it extends inland for a considerable distance, only three cities - Pomona, Riverside and San Bernardino - are far enough inland to be essentially free of the coastal influence. The three inland cities account for six percent of the total population sampled and would therefore exert little influence on the use in the South Coastal Hydrographic Area. As shown by Figure 3, the average water use throughout the year is consistently higher, by a small amount, in the South Coastal HA than in any of the other coastal areas.

In the northern part of the State, differences in per capita water use of cities are primarily due to climatic differences, extent of metering, industrial use, or extent of recreational use. The same reasons for differences also apply in the southern portion of the State, except for metering, because virtually all water use in southern California is metered. In many of the southern cities, however, these reasons are often not the only primary ones. Differences are also apt to be due to population density and such economic level factors as median incomes, market value of homes, size of lots and the use of water-using appliances.

In the Los Angeles metropolitan area, per capita water use for Burbank and Glendale, if based on climate alone, should have similar values. Burbank's higher use is associated with an extensive industrial complex, including aircraft manufacturing and a major motion picture-television complex with its large transient labor population. Helping to keep Glendale's per capita use low is the recycling of older residential sections into multiple-residential areas. This kind of development results in relatively less per capita water use than single-residential type because of the increased population density and the usually reduced water-using yard area. For these reasons, the unit urban water use in Burbank is much higher than in Glendale.

In Pasadena and Beverly Hills, the high water use is due to the low population density associated with the extensive areas of estate-type residences and high median income, two closely associated factors.

Census data indicates that the city of Fullerton in Orange County has a higher average annual per capita water use value than the neighboring cities of Anaheim and Santa Ana because of Fullerton's lower gross urban population density and higher per capita income. Similarly, Anaheim has a higher per capita water use than Santa Ana due to its higher median income and lower population density.

Four of the entities sampled in San Diego County - Chula Vista area cities and the cities of San Diego, Oceanside, and Escondido - have low per capita use because of low per capita income, high population densities, and a relatively high percentage of low-water-using residential development.

Carlsbad, the other city sampled in San Diego County, uses water at a rate twice that of its neighboring city of Oceanside just three miles north along the coast (303 gpcd versus 148). Water deliveries in Carlsbad are made to homes with ½ to 2 acres of irrigated citrus and avocado trees. This agricultural-residential type of development is well established in the community and can be expected to continue for some time.

(Sacramento River Basin HA) - This area, which includes nearly all of the Sacramento River drainage system, contains 6 percent of the State's population. Average monthly and annual values for 14 cities, representing approximately 35 percent of the 1,000,000 people in the hydrographic area, are presented in Table 3e.

The average annual per capita use shown in Figure 3 is a little less than double the use along the coast. The mean annual value is lower than those of almost all of the communities because the City of Sacramento, accounting for more than two-thirds of the sampled population, has an annual per capita use value lower than all other cities in the valley floor and foothill areas, except Liveoak.

The water use of the small communities around Clear Lake is primarily recreation-oriented. These communities have relatively high densities, a small proportion of the land area devoted to lawns and ornamental shrubs, and a high influx of recreation seekers during the summer. In Lakeport, for example, the population more than doubles between Memorial Day and Labor Day. The same method was used to determine per capita water use in Lakeport, Kelseyville, and Clearlake Highlands as was used in Santa Cruz in the Central Coastal Hydrographic Area.

The highest annual per capita use in the hydrographic area is for the community of Paradise. Originally, this community was an orchard area; however, in the past 15 years it has been converted rapidly to a low-density residential community while still retaining much of its agricultural characteristics. One of the attractions of the area has been the chance to own a home with a small orchard. As a result, a considerable portion of the water used by the community still goes to this purpose. There is no way of separating this use from water used for strictly residential purposes. However, if the present trend of conversion continues, the density of the community will increase and the agricultural use of water will diminish, with the resulting lowering of

TABLE 3e
AVERAGE MONTHLY AND ANNUAL URBAN UNIT WATER USE
AGENCY PRODUCED WATER
CITIES

SACRAMENTO RIVER BASIN
Hydrographic Area

County City	Agency* (Name and Type)	Period of Record	Yrs. of Rec.	Avg. Annual Water Into System (million gals.)	Average Estimated Population Served	Highest Monthly Use (gpcd)	Average Daily Water Use Monthly (gpcd) Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total Annually gpcd	afpcy
BUTTE																				
Chico	Cal. Water Service Co. (C.W.C.)	1960-64	5	3,777	30,797	803	112	118	146	269	374	641	753	664	457	256	136	108	336	.376
Gridley	- M.W.D.	1960-64	5	328	3,484	543	127	118	136	216	305	440	518	439	328	205	131	129	258	.289
Oroville	Cal. Water Service Co. (C.W.C.)	1961-65	5	1,251	10,200	740	164	158	165	289	301	478	577	722	613	288	176	164	336	.376
Paradise	Paradise I. D.	1961-65	5	1,552	13,900	1,246	-	74	-	97	-	315	-	693	-	540	-	114	306	.343
GLENN																				
Hamilton City	Cal. Water Service Co. (C.W.C.)	1960-64	5	76	721	313	118	123	142	246	347	524	582	517	377	250	137	109	289	.324
Willows	Cal. Water Service Co. (C.W.C.)	1960-64	5	403	4,104	598	120	125	134	219	295	479	590	474	360	220	136	120	269	.301
LAKE																				
Clearlake Highlands	Highland Water Co. (U.M.W.C.)	1961-65	5	63	1,385	-	-	-	-	-	-	-	-	-	-	-	-	-	125	.140
Clearlake Highlands	Highland Water Co. (U.M.W.C.)	1964-65	2	78	1,553	274	72	74	82	105	148	190	265	212	184	138	83	84	137	.153
Kelseyville	Kelseyville County Waterworks #1 (C.W.W.D.)	1961-65	5	30	919	-	-	-	-	-	-	-	-	-	-	-	-	-	88	.099
Kelseyville	Kelseyville County Waterworks #1 (C.W.W.D.)	1964-65	2	31	919	183	36	46	70	74	124	174	172	145	110	67	50	44	93	.104
Lakeport	- M.W.D.	1961-65	5	176	2,570	-	-	-	-	-	-	-	-	-	-	-	-	-	188	.211
Lakeport	- M.W.D.	1964-65	2	224	2,702	416	118	114	124	165	246	362	405	392	300	238	142	116	227	.254
PLACER																				
Placer County Foothill Cities	Pacific Gas & Electric (C.W.C.)	1960-64	5	1,228	11,721	580	151	153	137	154	203	316	489	548	515	374	241	166	287	.322
SACRAMENTO																				
Sacramento	- M.W.D.	1961-65	5	23,994	261,900	434	144	151	169	211	279	357	425	380	333	249	162	149	251	.281
SHASTA																				
Redding	- M.W.D.	1961-65	5	1,398	15,315	566	133	135	152	186	243	381	485	428	330	224	150	134	250	.280
SUTTER																				
Live Oak	- M.W.D.	1958-62	5	189	2,276	501	89	85	100	176	283	403	462	409	312	176	131	98	227	.254
TEHAMA																				
Corning	- M.W.D.	1959-60/4 (1964-66)	5	322	3,071	697	187	171	184	227	258	427	489	468	356	275	203	201	287	.321
YUBA																				
Marysville	Cal. Water Service Co. (C.W.C.)	1961-65	5	1,066	9,936	550	168	168	169	232	289	428	519	477	357	261	165	166	283	.316

* Refer to Table 3a for abbreviations (page 39)

per capita water use to approach that of other residential communities in the hydrographic area.

Rather high per capita use in Chico and Oroville may also reflect a similar transition from agricultural use to urban use, at least on the periphery of the two cities. Also contributing to Chico's high water use are the numerous large landscaped homesites with high external water requirements that are found within the city and the transient college student population.

The annual per capita water use of 250 gpcd for the community of Redding is rather modest compared with the rates in Chico, Oroville, and Paradise of 336, 336, and 306 gpcd, respectively. This is due in part to the greater population density; many residential areas are composed of small homes on small lots.

(Delta-Central Sierra Basin HA)* - This is the smallest of the 11 hydrographic areas of California, containing a little more than two percent of the State's population. Water use of 28 percent of this population, or approximately 104,000 people, was sampled. Average monthly and annual urban water use values for one city and two water service entities serving Stockton and four smaller foothill communities are shown in Table 3f.

TABLE 3f
AVERAGE MONTHLY AND ANNUAL URBAN UNIT WATER USE
AGENCY PRODUCED WATER
CITIES

DELTA-CENTRAL SIERRA BASIN
Hydrographic Area

County City	Agency* (Name and Type)	Period of Record	Yrs. of Rec.	Avg. Annual Water Into System (million gals.)	Average Estimated Population Served	Highest Monthly Use (gpcd)	Average Daily Water Use Monthly (gpcd)												Total Annually	
							Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	gpcd	afpcy
AMADOR																				
Amador County Foothill Cities	Pacific Gas & Electric (C.W.C.)	1960-64	5	386	3,343	527	208	250	209	208	271	318	389	423	471	393	348	305	316	.354
SAN JOAQUIN																				
Stockton	Cal. Water Service Co. (C.W.C.)	1961-65	5	7,461	88,869	421	109	113	121	153	203	279	368	380	410	294	218	125	230	.261
SOLANO																				
Vacaville	- M.W.D.	1960-65 1964-65	5	845	12,519	329	84	91	94	131	201	262	303	308	264	220	154	111	185	.207

* Refer to Table 3a for abbreviations (page 39).

One valley floor community, Vacaville, actually falls in the Sacramento River Basin, but has been included in this hydrographic area because, geographically and climatically, it is more closely tied to it. The four foothill communities

* This area makes up the northernmost segment of the San Joaquin River Basin Hydrographic Area as defined in Bulletin No. 2. See "Study Boundaries", Chapter I, for a discussion of this separation.

and the City of Stockton have their highest water use in September. While it is not known why the water use peaks at this time in Amador County foothill cities, it follows the same pattern as do the smaller foothill communities in the Sacramento River Basin. The September peak for Stockton is due to high use by the canneries processing tomatoes.

The average annual use in the Amador County foothill cities is rather high compared with valley floor use, which is in agreement with results obtained for foothill communities in the Sacramento River Basin. A possible explanation for this is that the foothill communities use more water in irrigating garden plots and small home orchards.

The relatively low average annual per capita use in the City of Vacaville is apparently due to small lot areas, which cause a slightly higher population density than in most valley communities.

(San Joaquin River Basin HA) - The San Joaquin River Basin is comparable to the Delta-Central Sierra Basin in population and also contains a little more than 2 percent of the State's population, 26 percent of which was sampled. In terms of water use, the comparison ends here. The San Joaquin River Basin has a mean annual gpcd of 316, while the Delta-Central Sierra Basin has 227. Average monthly and annual unit water use values for the six communities sampled are presented in Table 3g.

TABLE 3g
AVERAGE MONTHLY AND ANNUAL URBAN UNIT WATER USE
AGENCY PRODUCED WATER

SAN JOAQUIN RIVER BASIN
Hydrographic Area

CITIES

County City	Agency * (Name and Type)	Period of Record	Yrs. of Rec.	Avg. Annual Water Into System (million gals.)	Average Estimated Population Served	Highest Monthly Use (gpcd)	Average Daily Water Use Monthly (gpcd) Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total Annually gpcd	afpcy
MADERA																				
Madera	- M.W.D.	1963-65	3	1,960	15,300	710	149	174	214	265	453	582	681	625	450	312	166	143	351	.393
MERCED																				
Castle Gardens	U. S. Air Force	1961-65	5	328	3,025	703	81	114	203	295	402	533	594	514	390	236	115	85	297	.333
Los Banos	- M.W.D.	1965-66	2	756	10,254	389	94	112	134	170	248	260	336	352	262	224	116	100	202	.226
Merced	- M.W.D.	1961-65	5	3,027	26,000	650	124	135	164	252	384	543	649	591	420	282	159	128	319	.357
STANISLAUS																				
Ceres	Ceres Water Works, Inc. (C.W.C.)	1961-65	5	313	4,581	319	87	98	103	150	212	297	316	316	265	180	129	87	187	.209
Modesto	- M.W.D.	1961-65	5	4,811	37,660	682	133	149	189	282	406	540	633	632	535	377	185	144	350	.392

* Refer to Table 3a for abbreviations (page 39).

The data show there is nearly a two-fold variation from the lowest mean annual value of 187 gpcd for the city of Ceres to the highest values of 351 and 350 gpcd in Madera and Modesto, respectively. The low value in Ceres and in

Los Banos (202 gpcd) appear to be associated with the higher percentage of metering in the two cities than in the others. The percent of metered water agency deliveries in the six communities is shown below.

San Joaquin River Basin

Percent of Total Deliveries Metered (1965)

Los Banos	98
Ceres	71
Modesto	16
Madera	less than 1
Merced	0
Castle Gardens	0

These values, when compared with corresponding per capita values shown in Table 3g, indicate that metering has a strong bearing on per capita use. However, this is but one factor affecting water use, so departures from a direct relationship between metering and unit water use would be expected. For example, Los Banos, with 98 percent of its deliveries metered, has a higher per capita use than Ceres, with 71 percent. This is attributable to a significant amount of industry at Los Banos, while Ceres is almost exclusively residential.

Water use in the residential communities of Castle Gardens and Ceres would be expected to have similar unit water use values and patterns, but they are quite different. Castle Gardens, a United States Air Force housing center, has only residential water use. Ceres has some commercial and public water use, but these exert little, if any, influence on the average values. However, Castle Gardens has an average annual water use of 297 gpcd, while Ceres has one of only 170 gpcd. Castle Gardens has a three-month peak use period (June, July, and August) with an average peak value for these months of 547 gpcd. Ceres discloses a four-month peak period (June, July, August, and September) with an average of 271 gpcd. The peak month of water use at Castle Gardens is July, with an average value of 594 gpcd, which is twice the average annual water use. In Ceres, July and August are the peak months, each with an average value of 287 gpcd, which is only 1.7 times the average annual value.

Probable explanations for the large difference in metering between the two communities are metering and cost. Castle Gardens has no metering and homeowners are not charged for water, while Ceres is 71 percent metered and users are charged for water. Metering generally reduces water use because the user becomes acutely aware of the cost-quantity relationship and begins to use water more efficiently.

(Tulare Lake Basin HA) - This hydrographic area contains a little more than 5 percent of the State's population. The average monthly and annual per capita water use values for the seven cities presented in Table 3h are representative of approximately 42 percent of this population, or around 368,000 people.

TABLE 3h
AVERAGE MONTHLY AND ANNUAL URBAN UNIT WATER USE
AGENCY PRODUCED WATER

TULARE LAKE BASIN
Hydrographic Area

CITIES

County City	Agency* (Name and Type)	Period of Record	Yrs. of Rec.	Avg. Annual Water Into System (million gals.)	Average Estimated Population Served	Highest Monthly Use (gpcd)	Average Daily Water Use Monthly (gpcd) Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total Annually gpcd	afpcy
FRESNO																				
Fresno	- M.W.D.	1961-65	5	19,262	165,951	667	122	146	176	289	382	524	618	564	414	279	172	132	318	.356
Selma	Cal. Water Service Co. (C.W.C.)	1963-65	3	982	7,916	668	151	178	225	267	444	550	641	598	431	301	163	139	340	.381
KERN																				
Bakersfield	Cal. Water Service Co. (C.W.C.)	1961-65	5	13,861	119,048	646	135	169	209	288	393	528	604	549	392	275	161	128	319	.357
Delano	- M.W.D.	1962-65	4	1,774	12,989	751	177	206	263	342	472	587	654	630	464	336	198	179	376	.421
KINGS																				
Hanford	- M.W.D.	1961-65	5	1,785	18,112	515	111	133	178	246	352	457	503	455	326	234	134	108	270	.302
TULARE																				
Tulare	- M.W.D.	1961-65	5	1,684	14,887	671	127	143	198	269	392	542	601	533	375	263	158	119	310	.347
Visalia	Cal. Water Service Co. (C.W.C.)	1961-65	5	2,757	28,829	554	103	121	153	219	328	464	531	473	326	208	123	99	262	.293

* Refer to Table 3a for abbreviations (page 39).

The average annual gpcd values are essentially the same as those for the San Joaquin River Basin HA. The graphs of the annual monthly values in Figure 6 show the pattern of monthly use also to be quite similar. The noticeable difference is the tendency for a higher water use in the Tulare Lake Basin during the first half of the year and in the San Joaquin River Basin during the last half of the year. A reason may be, in part at least, the higher rainfall in the San Joaquin Basin, which results in greater soil moisture storage and delays the need for watering lawn and shrubbery areas.

More than three-fourth of the approximately 368,000 people included in the seven cities investigated live in the two largest communities in the area, Fresno and Bakersfield. These two cities have similar average annual per capita use. The average monthly values for Bakersfield, however, fluctuate less than those for Fresno.

In Bakersfield, more than 50 percent of the population served live outside the city boundaries in relatively low-density, low-water-using residential areas, while in Fresno, only about 10 percent of the population served live outside the

city. Because the Bakersfield unit values are strongly modified by the low water use of the suburban population, they are less than the Fresno values during the summer and fall. The reason for the reversal in the relationship during the winter is the year-round character of industrial use of water in the Bakersfield area. Industrial use is not primarily influenced by climate and hence does not drop during the winter.

Annual unit uses in Delano and Visalia, with similar climate and types of use, are quite dissimilar (376 and 262 gpcd, respectively). The difference is attributable to metering. Delano has no metering, while approximately 17 percent of Visalia's water connections are metered. These metered connections include most of the larger water-using commercial and industrial establishments, which are generally more strongly motivated through economic constraints to reduce waste.

As in Visalia, the industrial water use in Selma is highly metered. Selma has a larger number of industries with higher individual water requirements than Visalia and has a much lower population.

(South Lahontan HA) - This hydrographic area contains a little more than one percent of the State's population. The average monthly and annual data, available only for Victorville (which accounts for approximately four percent of the area's population) are shown in Table 31.

TABLE 31
AVERAGE MONTHLY AND ANNUAL URBAN UNIT WATER USE
AGENCY PRODUCED WATER
CITIES

SOUTH LAHONTAN
Hydrographic Area

County City	Agency* (Name and Type)	Period of Record	Yrs. of Rec.	Avg. Annual Water Into System (million gals.)	Average Estimated Population Served	Highest Monthly Use (gpcd)	Average Daily Water Use Monthly (gpcd)												Total Annually	
							Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	gpcd	afpcy
SAN BERNARDINO																				
Victorville	Victorville C.W.D.	1961-65	5	901	8,279	366	132	148	183	254	312	422	487	509	450	321	209	136	298	.334

* Refer to Table 3a for abbreviations (page 39).

Although Victorville has a high mean temperature and low rainfall, it has a lower annual per capita water use than both the San Joaquin River and Tulare Lake Basin HA's. Part of the difference is due not only to the smaller number of industries in Victorville than in the other areas but also to the smaller average water requirements of its individual industries.

The low residential use of water is partly due to low per capita income and partly due to high summer temperatures, which restrict the number and variety of ornamental plants that can be grown. In Victorville, as in most of the desert communities, yard areas tend to be smaller than those in Central Valley communities. These conditions result in

less outside residential water use. Similar conditions also prevail in other communities in the area.

(Colorado Desert HA) - This area contains a little more than one percent of the State's population. Average monthly and annual water use data for approximately 15 percent of the area's population in the two communities of El Centro and Indio are shown in Table 3j.

TABLE 3j
AVERAGE MONTHLY AND ANNUAL URBAN UNIT WATER USE
AGENCY PRODUCED WATER
CITIES

COLORADO DESERT
Hydrographic Area

County City	Agency * (Name and Type)	Period of Record	Yrs. of Rec.	Avg. Annual Water Into System (million gals.)	Average Estimated Population Served	Highest Monthly Use (gpcd)	Average Daily Water Use Monthly (gpcd) Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total Annually gpcd	afpcy
IMPERIAL																				
El Centro	- M.W.D.	1961-65	5	1,680	18,640	393	145	176	193	230	290	354	382	347	293	241	172	146	247	.277
RIVERSIDE																				
Indio	- M.W.D.	1961-65	5	1,415	12,000	642	161	205	223	295	322	486	551	518	396	271	240	186	323	.362

* Refer to Table 3a for abbreviations (page 39).

The Colorado Desert HA has an average annual unit water use that is 5 percent higher than the Sacramento River Basin, but its peak value is 5 percent less. Values for July, August, and September are higher in the Sacramento River Basin and for the remaining months (except for October when the value is the same for both areas) are higher in the Colorado Desert HA.

The lesser summer use, as in the South Lahontan HA, is primarily due to low income housing with small yards and low-water-using ornamental vegetation, while the higher use of water during the winter is accounted for by the longer growing season, which sustains the need for outside water application.

The rather pronounced higher use of water in Indio than in El Centro is due to the location of Indio. The community is a favorite stopover for weekend recreational travelers enroute to the Salton Sea and the Colorado River from the Los Angeles area. Also, the proximity of an important date and citrus industry, which requires considerable quantities of water for processing the fruit, results in a higher per capita use than in El Centro. Another influence, although indirect by comparison, is the recreational community of Palm Springs. It has raised the value of surrounding areas and encouraged residential and recreation-based commercial developments in Indio. Increased per capita water use results because of higher outside uses of water for landscaping and swimming pools and because of higher percentages of urban land devoted to greenery than in El Centro.

Private, Industry-Produced Fresh Water

Use of water agency records exclusively to obtain a complete picture of per capita water use will usually produce values that are lower than actual use. This is because a significant quantity of water produced by manufacturing establishments for their own use is not included. Some establishments use this water to supplement supplies purchased from water agencies; in other industries, it represents the entire supply of water used by that industry. The annual averages for private industry-produced water by hydrographic areas were obtained by weighting these water use values for each of those counties for which agency-produced unit values were obtained by the portion of that county's population within the hydrographic area, summing these quantities, and dividing this sum by the total population for the hydrographic area. Table 4 presents a summary of the hydrographic area values.

The data used in this procedure were developed from estimates of water used by manufacturers in each county based on reported intake by source (private or public) and number of employees for each industrial group, as presented in Bulletin No. 124. Data from approximately 5,400 reporting firms, representing approximately 50 percent of total manufacturing employment during the 1957-59 period, were used in these estimates. In Shasta County, a sizable additional use of water has been introduced since Bulletin No. 124 by a pulp mill near Anderson. In 1966, this mill used approximately 12,100 acre-feet of water, which was about the same as used in 1965. When this use is related to the populations of Shasta County and of the portion of the hydrographic area studied, it adds 145 gpcd and 11 gpcd, respectively.

The per capita water use values developed by county and used as a basis for computing the hydrographic area values are shown in Table 5. The total quantity of water represented by these figures is approximately 60 percent of all reported industrial fresh water intake. The balance of the water used is obtained from water service agencies. In general, the data reflects water use by the high-water-using industries. A more detailed analysis of unit water use of private, industry-produced fresh water may be found in Bulletin No. 124.

Private, Industry-Produced Brackish Water

The use of brackish water, while usually having little direct bearing on projects designed to harness and distribute fresh water, is of importance because it provides an insight into the extent that fresh water supplies might be substituted by brackish water in industries not now using brackish water, or vice versa. As coastal and inland bay sites for the location of such establishments diminish, some may be forced to locate inland and to rely on fresh water supplies. Knowing the water requirements of such industries is an important part

TABLE 4

AVERAGE ANNUAL URBAN UNIT WATER USE
PRIVATE, INDUSTRY-PRODUCED FRESH WATER
(1957-1959)

Hydrographic Areas

Hydrographic Area	Estimated Private, Industry-Produced Fresh Water[1] (million gal.)	Population (x 1000) [2]	Average Annual	
			gpcd	afpcy
North Coastal	8,600	279	84	.094
San Francisco Bay	28,225	3,327[4]	23	.026
Central Coastal	7,750	568	37	.041
South Coastal	30,192	7,521[4]	11	.012
Sacramento River Basin	13,847[3]	762[4]	50	.056
Delta-Central Sierra Basin	9,787	308[4]	87	.097
San Joaquin River Basin	9,080	327	76	.085
Tulare Lake Basin	10,115	830	33	.037
South Lahontan	1,784	164	30	.034
Colorado Desert	777	175[4]	12	.013
SUMMARY	120,157	14,261[4]	23[5]	.026

1/ Developed from Table 5 . Water production values for portions of counties split by hydrographic area boundaries were apportioned from total county values using appropriate population figures.

2/ From U. S. Census data for 1960. Populations for portions of divided counties determined by Department of Water Resources.

3/ Does not include water used by pulp mill in Anderson, Shasta County. Although the 1960 use is not known, the 1966 use was estimated at 12,100 acre-feet. Relating this amount to the known 1965 population for the same area adds 11 gpcd.

4/ Populations of counties with gpcd values less than one (San Diego, Solano, and Yuba) were not included. In addition, the population for the portion of Napa County occurring in the Sacramento River Basin were not included because total water produced was less than one million gallons.

5/ This value differs from the value shown in Table 5 because of population differences. See footnote 4/, above.

TABLE 5
AVERAGE ANNUAL URBAN UNIT WATER USE
PRIVATE, INDUSTRY-PRODUCED FRESH WATER
(1957-1959)

Counties

County	Population (x 1000) 1/	Estimated Total County Fresh Water 2/ (Million gals.)	Percent Private, Industry-Produced 3/	Estimated Private Industry-Produced Fresh Water (Million gals.)	Average Annual	
					gpcd	afpcy
Alameda	908.2	11,614	46	5,354	16	.018
Amador	10.0	321	26	83	23	.026
Butte	82.0	1,905	97	1,841	62	.069
Contra Costa	409.0	39,112	52	20,377	136	.153
Del Norte	17.8	88	97	85	13	.015
Fresno	365.9	7,436	75	5,599	42	.047
Glenn	17.2	1,213	100	1,208	192	.215
Humboldt	104.9	5,414	58	3,113	81	.091
Imperial	72.1	1,418	13	179	7	.008
Kern	292.0	4,172	75	3,112	29	.033
Kings	50.0	1,584	73	1,163	64	.071
Lake	13.8	177	99	176	35	.039
Los Angeles	6,038.8	73,090	34	24,997	11	.013
Madera	40.5	874	99	869	59	.066
Marin	146.8	266	17	45	1	.001
Mendocino	51.1	3,993	99	3,957	212	.238
Merced	90.4	2,377	98	2,332	71	.079
Monterey	198.3	3,132	98	3,057	42	.047
Napa	65.9	446	3	15	1	.001
Orange	703.9	5,803	26	1,491	6	.006
Placer	53.8	198	65	129	6	.007
Riverside	306.2	2,330	72	1,677	15	.017
Sacramento	502.8	5,593	88	4,911	27	.030
San Benito	15.4	388	99	383	68	.076
San Bernardino	503.6	5,584	61	3,412	19	.021
San Diego	1,033.0	6,096	1	67	-	-
San Francisco	740.3	3,428	5	165	1	.001
San Joaquin	250.0	9,075	85	7,750	85	.095
San Luis Obispo	81.0	805	93	750	25	.028
San Mateo	444.4	2,105	12	251	2	.002
Santa Barbara	169.0	2,759	99	2,726	44	.050
Santa Clara	642.3	6,013	71	4,287	18	.020
Santa Cruz	84.2	733	87	640	21	.023
Shasta 4/	59.5	4,361	99	4,326	199	.223
Solano	134.6	266	1	3	-	-
Sonoma	147.4	2,220	91	2,024	38	.042
Stanislaus	157.3	6,571	74	4,830	84	.094
Sutter	33.4	258	67	172	14	.016
Tehama	25.3	2,646	49	1,289	140	.156
Tulare	168.4	1,030	77	797	13	.015
Ventura	199.1	1,419	41	585	8	.009
Yuba	33.9	3	77	2	-	-
SUMMARY	15,463.5	228,316	53	120,229	21	.023

1/ 1960 U. S. Census
2/ From Table 6, Bulletin No. 124, "Water Use by Manufacturing Industries in California 1957-59".
3/ Computed from Table 2, Bulletin No. 124.
4/ Does not include water used by pulp mill in Anderson. Although the 1960 use is not known, the 1966 use was estimated at 12,100 acre feet. Relating this amount to the known 1965 population for the county adds 145 gpcd.

of water development planning irrespective of quality of water. Average annual per capita brackish water values are shown by hydrographic area in Table 6. The county values developed from Bulletin No. 124 data and used to derive the hydrographic area values are presented in Table 7. The data presented in Tables 6 and 7 account for 46 percent of all intake water used by manufacturing establishments (excluding intake of water for cooling and for steam generation plants) and exceed fresh water intake from either public water supplies or from company-produced sources. The highest users are the petroleum refining and related industries group, which rely on brackish water for 75 percent of their intake, and the chemical and allied products group, which use 53 percent brackish water. A more thorough analysis of unit water use of private, industry-produced brackish water may be found in Bulletin No. 124.

Total Per Capita Water Use

In Table 8, the three main components of urban per capita water use are summarized by county within hydrographic areas. In Tables 9 and 10, separate listings of per capita water use are presented by hydrographic areas and by counties.

The data in Table 10 discloses that, in all counties except Mendocino, agency-produced water was the main source of fresh water. In 14 of the 43 counties reported upon, private, industry-produced fresh water provides more than 20 percent of the total fresh water used in the counties. The importance of this component is clearly seen in the values for the three counties in the North Coastal HA. The addition of private, industry-produced fresh water has resulted in a complete reversal of the agency-produced county values. Del Norte county goes from the highest to the lowest user of the three, while Mendocino goes from the lowest to the highest.

Table 9 also clearly shows the changing relationships that can result. For example, the ranking of the San Francisco Bay HA per capita use value on the basis of agency-produced data is second lowest of the 11 areas. When private, industry-produced fresh water is added, it acquires the lowest ranking. Adding brackish water boosts it back up to the second lowest spot.

TABLE 6

AVERAGE ANNUAL URBAN UNIT WATER USE
PRIVATE, INDUSTRY-PRODUCED BRACKISH WATER
(1957-1959)

Hydrographic Areas

Hydrographic Area	Estimated Brackish Water (Million Gals) 1/	Population (x 1000) 2/	Average Annual	
			gpcd	afpcy
North Coastal	3,099	227	37	.041
San Francisco Bay	46,263	3,115	41	.046
Central Coastal	2,181	219	27	.030
South Coastal	90,534	8,128	30	.034
Sacramento River Basin	-	-	-	-
Delta-Central Sierra	9,334	273	94	.105
San Joaquin River Basin	616	29	58	.065
Tulare Lake Basin	6,560	168	107	.120
South Lahontan	1,274	127	27	.030
Colorado River Basin	90	24	10	.011
SUMMARY	159,951	12,310	36	.040

1/ Developed from Table 7 . Water production values for portions of counties split by hydrographic area boundaries were apportioned from total county values using appropriate population figures.

2/ From U. S. Census data for 1960. Populations for portions of divided counties determined by Department of Water Resources.

TABLE 7

AVERAGE ANNUAL URBAN UNIT WATER USE
PRIVATE, INDUSTRY-PRODUCED BRACKISH WATER
(1957-1959)
Counties

County	Estimated Brackish Water (million gal.) 1/	Population (x 1000) 2/	Average Annual	
			gpcd	afpcy
Alameda	5,495	908.2	16	.018
Contra Costa	37,304	409.0	250	.280
Del Norte	33	17.8	5	.006
Humboldt	2,306	104.9	60	.067
Los Angeles	77,424	6,038.8	35	.039
Monterey	2,057	198.3	28	.031
Orange	3,771	703.9	15	.017
San Bernardino	1,654	503.6	9	.010
San Diego	8,944	1,033.0	24	.027
San Francisco	4,094	740.3	15	.017
San Joaquin	5,048	250.0	55	.062
San Mateo	1,015	444.4	6	.007
Santa Clara	3,075	642.3	13	.015
Sonoma	1,066	147.4	20	.022
Tulare	6,560	168.4	11	.012
SUMMARY	159,846	12,310.3	36	.040

1/ Developed from data in Tables 2 and 6 of Bulletin No. 124, "Water Use by Manufacturing Establishments in California, 1957-1959", assuming a direct relationship between number of employees and water use and between fresh and brackish water use in those industries using brackish water.

2/ 1960 U. S. Census

TABLE 8

AVERAGE ANNUAL URBAN UNIT WATER USE
COMBINED SOURCES

Counties by Hydrographic Area

HA 1/	County	Total Per Capita Use (gpcd)	Brackish	Fresh Water			
			Private Industry Produced (gpcd)	Agency Produced (gpcd) 2/	Private, Industry Produced (gpcd)	Total Fresh	
						gpcd	afpcy
NC	Del Norte	156	5	138	13	151	.169
	Humboldt	263	60	122	81	203	.227
	Marin	1	-	-	1	1	.001
	Mendocino	379	-	167	212	379	.425
	Sonoma	217	20	159	38	197	.221
SF	Alameda	190	16	158	16	174	.177
	Contra Costa	548	250	162	136	298	.350
	Marin	149	-	148	1	149	.167
	Napa	179	-	178	1	179	.200
	San Francisco	141	15	125	1	126	.141
	Santa Clara	188	13	157	18	175	.196
	San Mateo	132	6	124	2	126	.141
	Solano	185	-	185	-	185	.207
	Sonoma	218	20	173	38	211	.236
CC	Monterey	193	28	123	42	165	.185
	San Benito	216	-	148	68	216	.242
	San Luis Obispo	213	-	188	25	213	.238
	Santa Barbara	212	-	168	44	212	.237
	Santa Clara	199	13	168	18	186	.208
	Santa Cruz	178	-	157	21	178	.199
SC	Los Angeles	218	35	172	11	183	.205
	Orange	206	15	185	6	191	.214
	Riverside	244	-	229	15	244	.273
	San Bernardino	240	9	212	19	231	.259
	San Diego	150	24	126	-	126	.141
	Ventura	166	-	158	8	166	.186
SB	Butte	392	-	330	62	392	.439
	Glenn	464	-	272	192	464	.520
	Lake	186	-	151	35	186	.208
	Napa	1	-	-	1	1	.001
	Placer	293	-	287	6	293	.328
	Sacramento	278	-	251	27	278	.311
	Shasta	449	-	250	199	449	.503
	Solano	-	-	-	-	-	-
	Sutter	241	-	227	14	241	.270
	Tehama	427	-	287	140	427	.478
	Yuba	283	-	283	-	283	.317
DC	Alameda	32	16	-	16	16	.018
	Amador	339	-	316	23	339	.380
	Contra Costa	386	250	-	136	136	.152
	Sacramento	27	-	-	27	27	.030
	San Joaquin	370	55	230	85	315	.353
	Solano	185	-	185	-	185	.207
	Stanislaus	316	-	232	84	316	.354
SJ	Fresno	42	-	-	42	42	.047
	Madera	410	-	351	59	410	.459
	Merced	357	-	286	71	357	.400
	San Joaquin	140	55	-	85	85	.095
	Stanislaus	414	-	330	84	414	.464
TB	Fresno	360	-	318	42	360	.403
	Kern	354	-	325	29	354	.396
	Kings	334	-	270	64	334	.374
	San Benito	68	-	-	68	68	.076
	Tulare	302	11	278	13	291	.326
SL	Kern	29	-	-	29	29	.032
	Los Angeles	11	35	-	11	11	.012
	San Bernardino	326	9	298	19	317	.355
CD	Imperial	254	-	247	7	254	.284
	Riverside	338	-	323	15	338	.378
	San Bernardino	28	9	-	19	19	.021
	San Diego	24	24	-	-	-	-
WEIGHTED AVERAGES		229 3/	36	172	21	193 3/	.216

1/ HA - Hydrographic Area

2/ Unit values for portions of divided counties differ because they have been weighted by average populations of communities studied in each portion. Missing values indicate no communities were studied in that portion of the county.

3/ Obtained by summing laterally. These values cannot be obtained by weighting the HA values above them because of the use of two different population bases for obtaining total fresh water.

TABLE 9

AVERAGE ANNUAL URBAN UNIT WATER USE
COMBINED SOURCES

Hydrographic Areas

Hydrographic Area	Total Per Capita Use (gpcd)	Brackish	Fresh Water			
		Private, Industry Produced (gpcd)	Agency Produced (gpcd)	Private Industry-Produced (gpcd)	Total Fresh	
					gpcd	afpcy
North Coastal	264	37	143	84	227	.254
San Francisco Bay	210	41	146	23	169	.189
Central Coastal	212	27	148	37	185	.207
South Coastal	208	30	167	11	178	.199
Sacramento River Basin	313	-	263	50	313	.350
Delta-Central Sierra Basin	408	94	227	87	314	.352
San Joaquin River Basin	450	58	317	76	392	.439
Tulare Lake Basin	454	107	314	33	347	.389
South Lahontan	355	27	298	30	328	.367
Colorado Desert	299	10	277	12	289	.324
WEIGHTED AVERAGES	231*	36	172	23	195*	.218

* Obtained by summing laterally. These values cannot be obtained by weighting the HA values above them because of the use of two different population bases for obtaining total fresh water.

TABLE 10

AVERAGE ANNUAL URBAN UNIT WATER USE
COMBINED SOURCES

Counties

County	Total Per Capita Use (gpcd)	Brackish	Fresh Water			
		Private, Industry Produced (gpcd)	Agency Produced (gpcd)	Private, Industry Produced (gpcd)	Total Fresh	
					gpcd	afpcy
Alameda	174	6	142	16	158	.177
Amador	339	-	316	23	339	.380
Butte	392	-	330	62	392	.439
Contra Costa	563	250	177	136	313	.351
Del Norte	156	5	138	13	151	.169
Fresno	360	-	318	42	360	.403
Glenn	464	-	272	192	464	.520
Humboldt	263	60	122	81	203	.227
Imperial	254	-	247	7	254	.284
Kern	353	-	324	29	353	.395
Kings	334	-	270	64	334	.374
Lake	186	-	157	35	186	.208
Los Angeles	217	35	171	11	182	.204
Madera	410	-	351	59	410	.459
Marin	148	-	147	1	148	.166
Mendocino	379	-	167	212	379	.425
Merced	357	-	286	71	357	.400
Monterey	193	28	123	42	165	.185
Napa	179	-	178	1	179	.200
Orange	206	15	185	6	191	.214
Placer	293	-	287	6	293	.328
Riverside	249	-	234	15	249	.279
Sacramento	278	-	251	27	278	.311
San Benito	215	-	147	68	215	.241
San Bernardino	247	9	219	19	238	.267
San Diego	150	24	126	-	126	.141
San Francisco	141	15	125	1	126	.141
San Joaquin	370	55	230	85	315	.353
San Luis Obispo	213	-	188	25	213	.238
San Mateo	132	6	124	2	126	.141
Santa Barbara	212	-	168	44	212	.237
Santa Clara	188	13	157	18	175	.196
Santa Cruz	178	-	157	21	178	.199
Shasta	449	-	250	199	449	.503
Solano	185	-	185	-	185	.207
Sonoma	218	20	160	38	198	.222
Stanislaus	414	-	330	84	414	.464
Sutter	241	-	227	14	241	.270
Tehama	427	-	287	140	427	.478
Tulare	302	11	278	13	291	.326
Ventura	166	-	158	8	166	.186
Yuba	283	-	283	-	283	.317
WEIGHTED AVER.	229*	36	172	21	193*	.216

* Obtained by summing laterally. These values cannot be obtained by weighting the HA values above them because of the use of two different population bases for obtaining total fresh water.

Other Components of Urban Water Use*

In addition to the three components of urban per capita water use discussed in the previous sections, two additional components exist. These components are privately produced water by residential users and by commercial establishments. The significance of these components depends largely on whether there is an available ground water supply and whether the community has incorporated into its water system many areas originally without municipal water. One area where this condition is significant is South Alameda County. The expanding cities have annexed a large number of urban areas previously without an incorporated water system and the residential users have continued to supply their needs by individual wells. Unfortunately, there is no source of information which can provide an insight into the magnitude of such uses. For this reason, it can only be mentioned here that these components do exist and that any endeavor to quantify them will be a future undertaking.

* A more complete discussion of this subject is presented under "Unreported Water Use", Chapter II.

CHAPTER IV. TRENDS IN PER CAPITA WATER USE

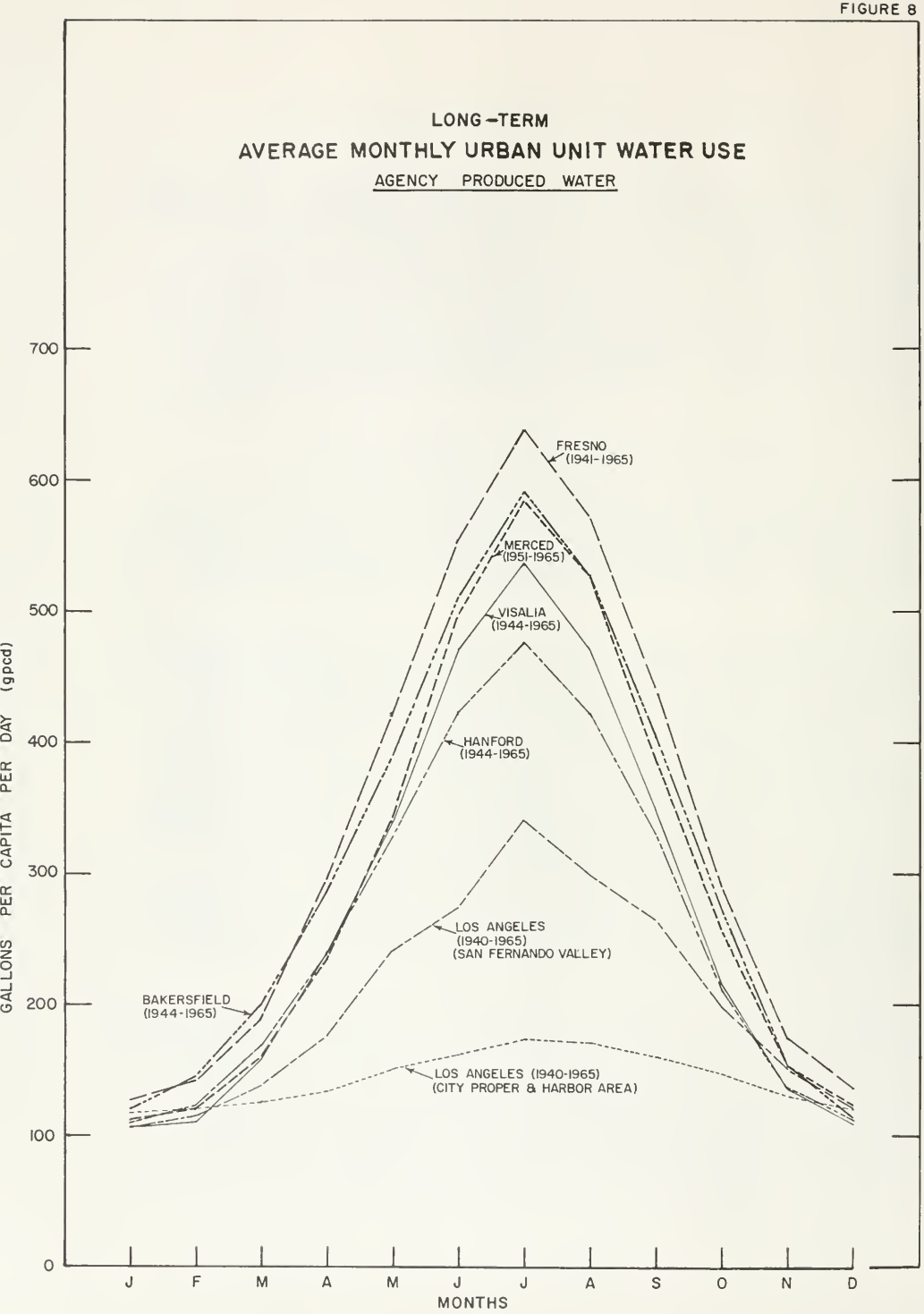
The limitations in using long-term data in developing representative per capita values for various regions of the State were discussed in the previous chapter. However, such data have considerable utility for other purposes. They are especially useful in revealing the nature of monthly urban water use. For example, the data can be used to determine: (1) fluctuations in monthly values around a mean, (2) which month has the greatest variability in relation to the mean value, and (3) the general direction of use, whether up or down, with time. The latter item is important because it may provide a clue to the factors that influence total use.

Variability and Trends of Monthly Values

Long-period averages, covering periods ranging from 15 to 26 years, of six cities have been plotted in Figure 8 to show the appreciable differences in monthly use between communities in similar climatic-geographic regions and the large differences between cities in dissimilar climatic-geographic regions.

The analysis was limited to five cities in the San Joaquin Valley (Merced, Fresno, Hanford, Visalia, and Bakersfield) and two portions of Los Angeles because long-term monthly values either were not available for other communities or were not practical to develop. Although the trends in the San Joaquin Valley may not be entirely typical of those in larger population centers, they reveal a number of factors affecting urban water use which can help to explain monthly unit use patterns in any community. As an example, the data revealed that the direction and magnitude of yearly fluctuations for many months (including winter months) were generally quite similar in each of the five cities. This similarity between dissimilar cities is due to the influence of climatic factors on outside use. The similarity during the winter months indicates that climate is more important during this period than had been supposed.

Some of the more important reasons for the differences between the five cities in the San Joaquin Valley are discussed in Chapter III under the sections "San Joaquin River Basin HA" and "Tulare Lake Basin HA". The differences shown between the two portions of Los Angeles which lie in two different climatic zones, and between those areas and the San Joaquin Valley cities are primarily due to climate. The relationship of water use to climate in the three climatic zones represented by these cities is discussed more fully in the section


LONG-TERM
AVERAGE MONTHLY URBAN UNIT WATER USE
AGENCY PRODUCED WATER
GALLONS PER CAPITA PER DAY (gpcd)
700
600
500
400
300
200
100
0
FRESNO
(1941-1965)
MERCED
(1951-1965)
VISALIA
(1944-1965)
HANFORD
(1944-1965)
LOS ANGELES
(1940-1965)
(SAN FERNANDO VALLEY)
BAKERSFIELD
(1944-1965)
LOS ANGELES (1940-1965)
(CITY PROPER & HARBOR AREA)
J
F
M
A
M
J
J
A
S
O
N
D
MONTHS

on "Temperature" in Chapter II. In the sections below, the monthly pattern of per capita use in the six cities is examined in some detail. Figures 9a through 9f show monthly data for each city. Averages for the data have been drawn as have high and low values.

San Joaquin Valley Cities

Merced (Figure 9a) - Per capita water use increased rather steadily for every month during the 15 years studied. September appears to be the least variable month with a 27 percent range in values from the average. January is next, followed by December and July. The most variable month appears to be April with 27 percent range in values from the average. October and March follow with ranges of 57 to 55 percent, respectively. The high range in March, April, and October is primarily due to erratic rainfall patterns.

Fresno (Figure 9b) - The monthly trends in this city for the 25 year period studied are not as definite as in Merced. The data reveal essentially no trend for nine months and a downward trend for three months; no upward trends are apparent. The comparison of the most recent five year average with the 25 year average shows that every month except February has shown a downward trend in per capita use. Most of the reasons for the downward trend are explained in Chapter III. As observed in Merced, per capita use in September shows the smallest percent in range of values from the average, followed by July and August. April again shows the greatest variability, followed by March and December. The variability during the winter in Fresno is more than twice as great as in Merced. This is due to the influence of relatively high manufacturing use of water in Fresno.

Hanford (Figure 9c) - The 22 years of data reveal apparently two different trends. In the winter months of November, December, and January, a noticeable downward trend exists, whereas from April through October there is a definite upward trend. What causes these two patterns is not known. The lowest range in values from the average occurs in August, followed by September and July. The greatest range occurs in January and is followed by March and February.

Visalia (Figure 9d) - Trends in this city over the 22 years studied appear to be quite variable. The months of June, July, and August are the only ones that show an upward trend. Except for March and October, the rest of the months show a declining per capita water use. During four of the months, the monthly trends established during the first 18 years of record appear to have been disrupted by approximately the last six. In February the

Figure 9a

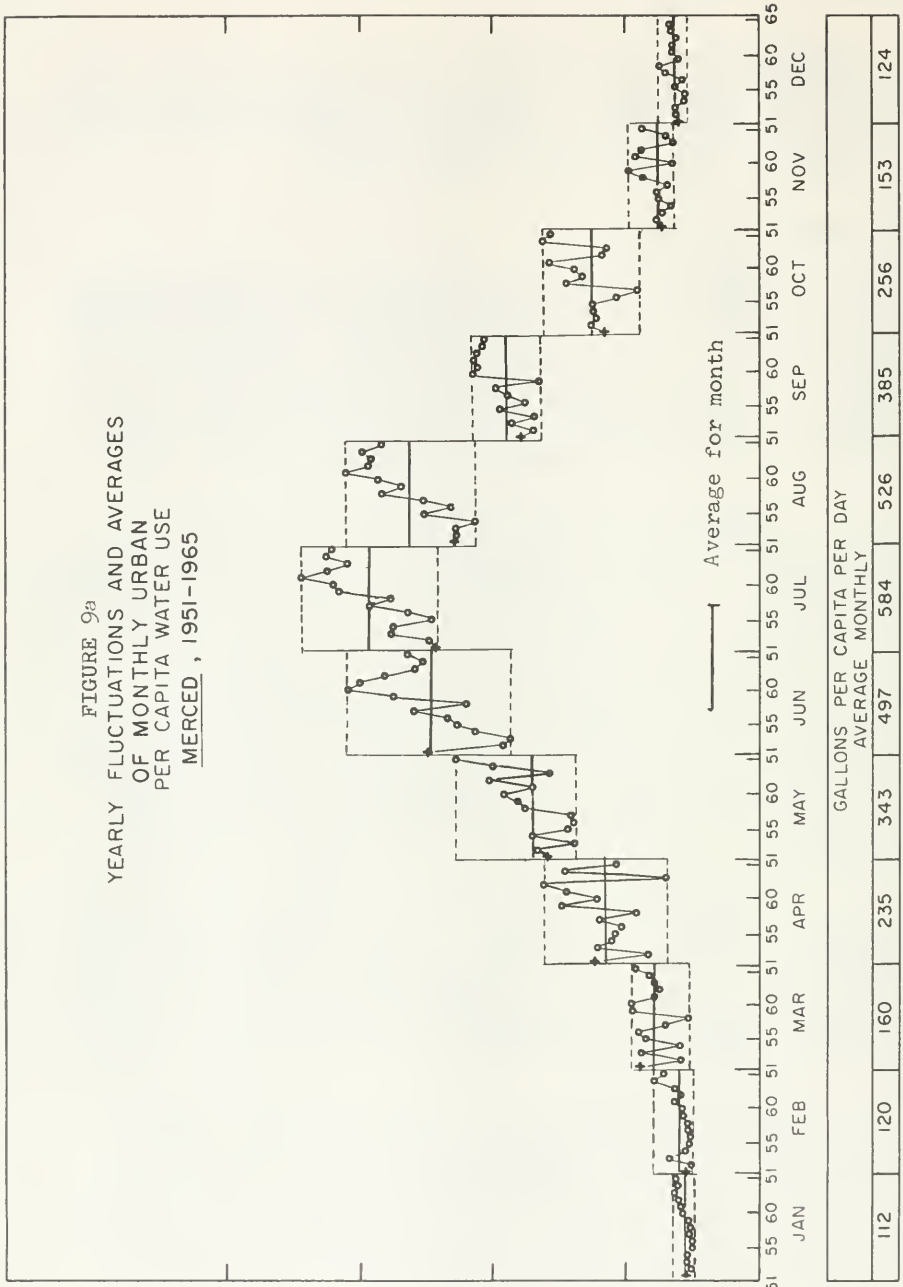
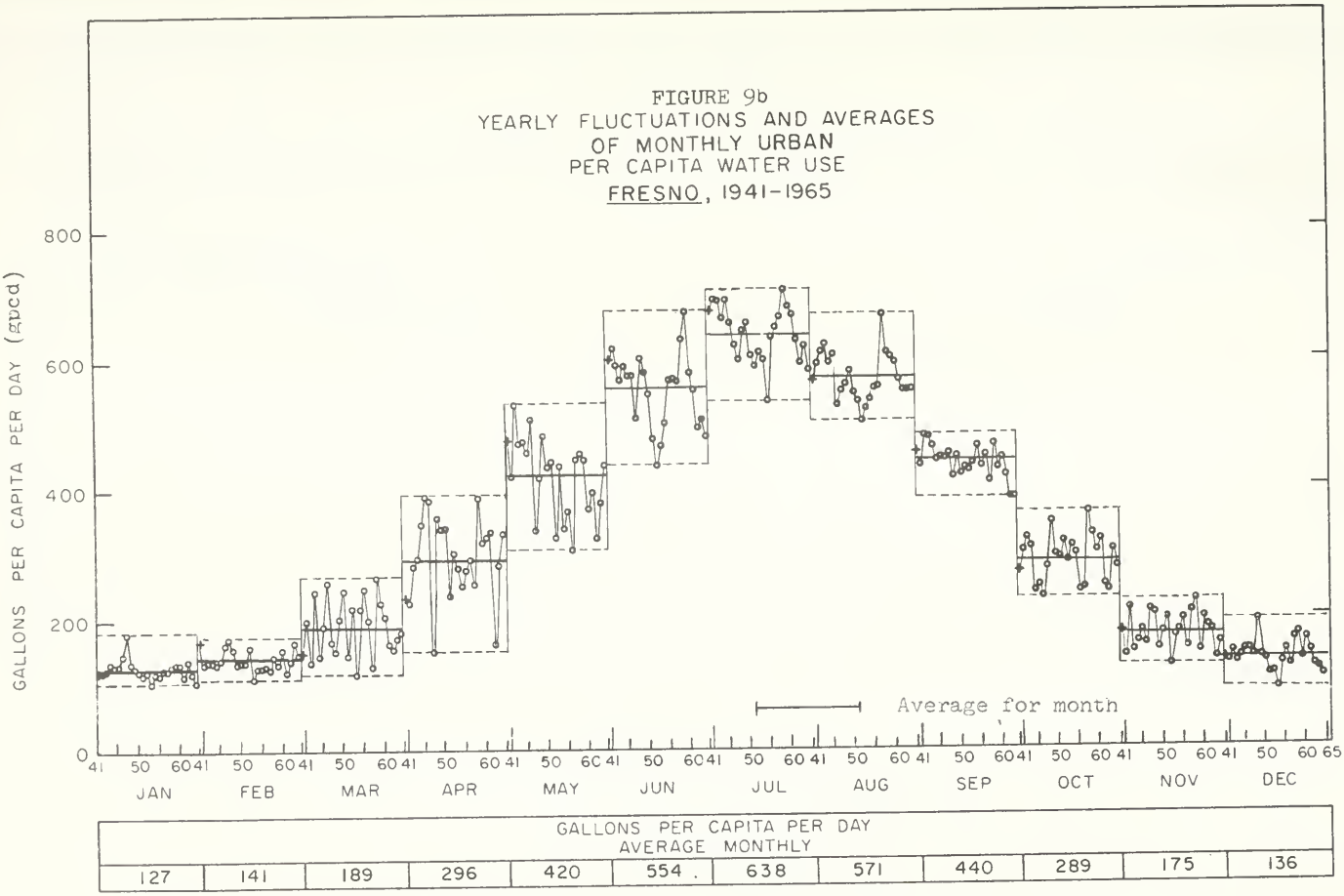


FIGURE 9a
YEARLY FLUCTUATIONS AND AVERAGES
OF MONTHLY URBAN
PER CAPITA WATER USE
MERCED , 1951-1965
GALLONS PER CAPITA PER DAY (gpcd)
0
200
400
600
800
51 55 60 51 55 60 51 55 60 51 55 60 51 55 60 51 55 60 51 55 60 51 55 60 51 55 60 51 55 60 51 55 60 65
JAN FEB MAR APR MAY JUN JUL AUG SEP OCT NOV DEC
Average for month
GALLONS PER CAPITA PER DAY
AVERAGE MONTHLY
112 120 160 235 343 497 584 526 385 256 153 124



GALLONS PER CAPITA PER DAY AVERAGE MONTHLY											
127	141	189	296	420	554	638	571	440	289	175	136

Figure 9b

Figure 9c

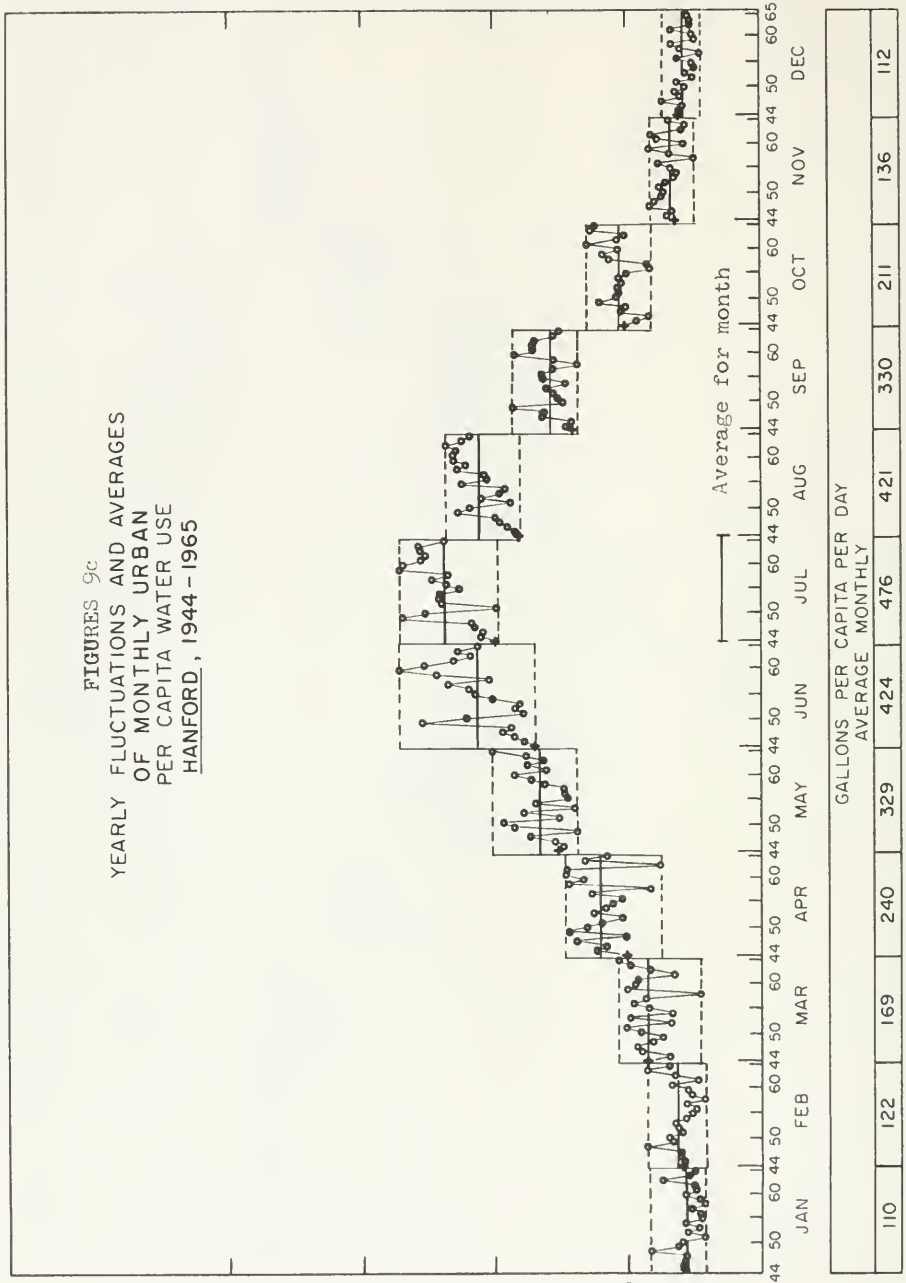
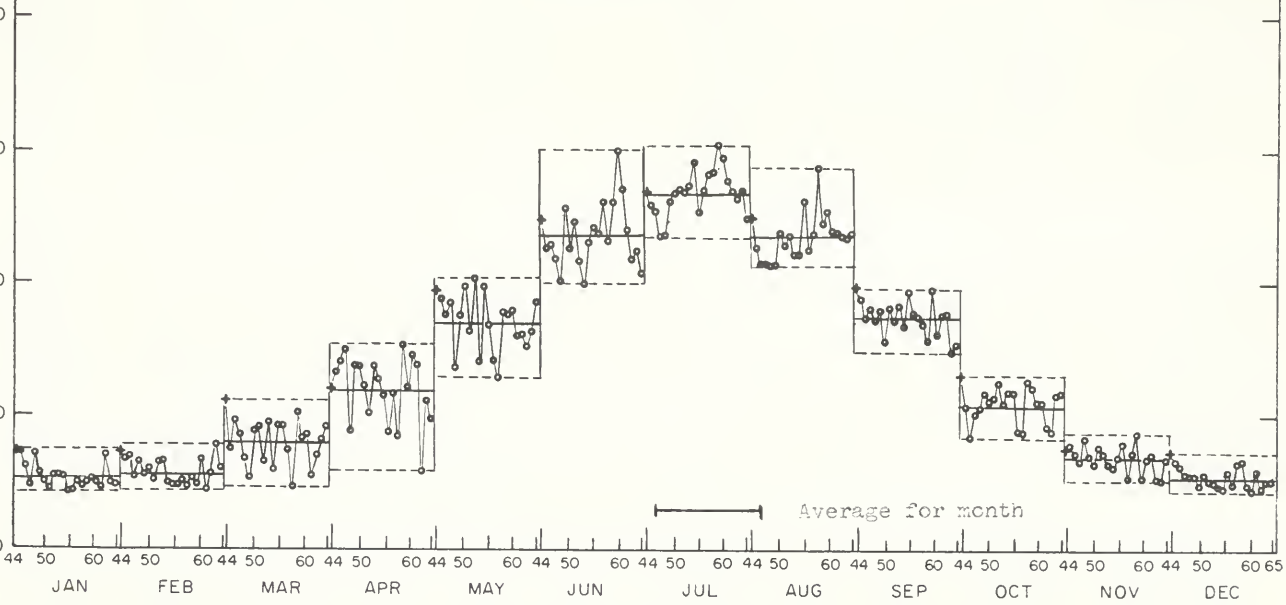

FIGURES 9c
YEARLY FLUCTUATIONS AND AVERAGES
OF MONTHLY URBAN
PER CAPITA WATER USE
HANFORD, 1944-1965
GALLONS PER CAPITA PER DAY (gpcd)
0
200
400
600
800
JAN
FEB
MAR
APR
MAY
JUN
JUL
AUG
SEP
OCT
NOV
DEC
Average for month
GALLONS PER CAPITA PER DAY
AVERAGE MONTHLY
110
122
169
240
329
424
476
421
330
211
136
112

FIGURE 9d
YEARLY FLUCTUATIONS AND AVERAGES
OF MONTHLY URBAN
PER CAPITA WATER USE
VISALIA, 1944-1965



GALLONS PER CAPITA PER DAY AVERAGE MONTHLY											
106	110	159	237	340	471	536	470	348	216	136	108

Figure 9d

downward trend has been interrupted by a sizable uptrend. In contrast, the definite upward trends noted in June, July, and August have been interrupted by downward trends. July values range least from the average followed by September and then August. The highest range occurs in March, followed by April and February.

Bakersfield - Data covering the period 1944 to 1965 are shown in Figure 9e. Of particular interest in this city is the greater variability in the use of water, with respect to the average, during January and February than in the other cities studied. This variability is due to the outside use of water. The relatively mild winter conditions that frequently prevail in the city encourage vegetative growth. Because rainfall generally is insufficient to meet outside plant needs, some watering is necessary. When this condition prevails, even a small amount of external watering becomes a large part of the total use. As a result, per capita values tend to reflect this use. Since the factors that give rise to this condition are quite variable, per capita use also is quite variable. The least variability around the average occurs in the month of July, followed by August and November. For some unknown reason the range in values from the average for July was only 18 percent, which is considerably less than for the other cities.

Combined San Joaquin Valley Cities

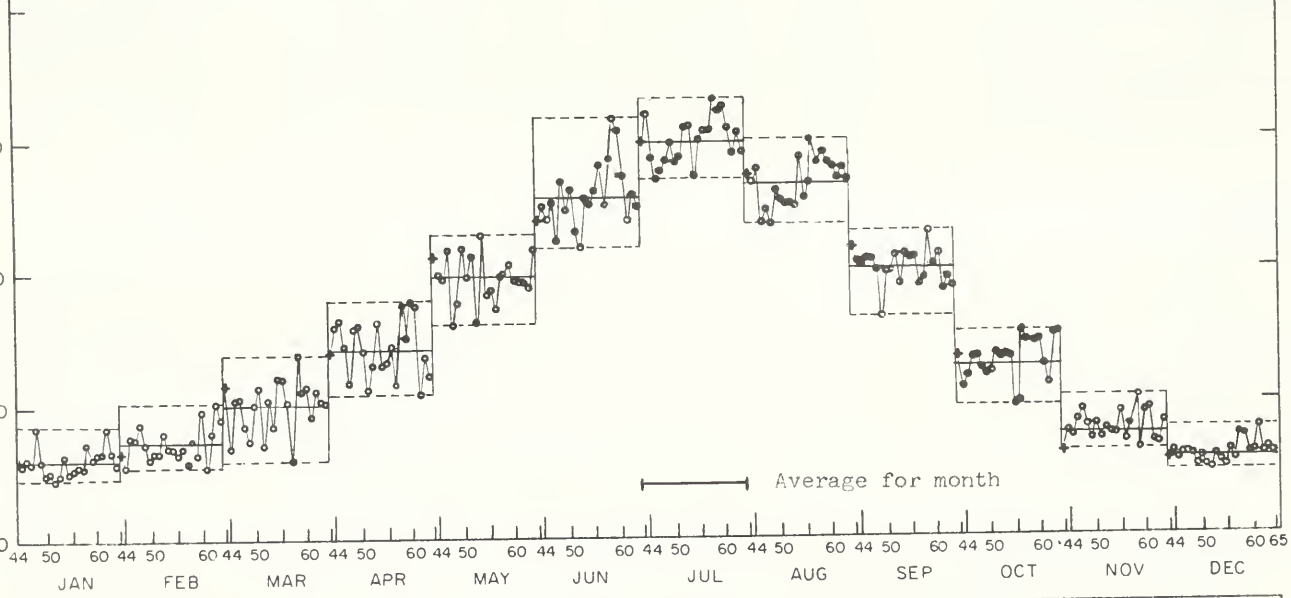
The monthly unit values for the period 1944-1965 for four of the five cities discussed above were weighted by population and evaluated using the two-variable least squares method to determine if these historic unit values would provide a statistically sound basis for extrapolating future monthly values.

The limitations in using annual unit values for this purpose have already been pointed out. Although encumbered by many of the same problems, the extrapolation of historic monthly values would be expected to provide a more reliable system. The results, however, as presented in Figure 10*, indicate that the values for cities in the Tulare Lake Basin are too variable for this purpose. This is shown on Figure 10 graphically by the range lines and statistically by the low correlation coefficients. Only September has a correlation coefficient greater than the acceptable minimum value of 0.4 for a two-variable least squares analysis consisting of 22 data points.

The coefficients for the remaining 11 months, being less than 0.4, indicate that the trend lines, irrespective of degree of slope, are not reliable for use in extrapolating future per capita unit use values. The apparent lack of a time-trend between gpcd unit values and time in this hydrographic area

* Bound at end of the report.

FIGURE 9e
YEARLY FLUCTUATIONS AND AVERAGES
OF MONTHLY URBAN
PER CAPITA WATER USE
BAKERSFIELD, 1944-1965



GALLONS PER CAPITA PER DAY AVERAGE MONTHLY											
120	145	200	286	390	510	590	525	404	271	154	114

Figure 9e

appears to contradict a common notion that such values increase during a time of increasing urban complexities. The analysis also clearly demonstrates the need for more information on the individual component urban uses and for a comprehensive in-depth evaluation of various factors influencing each of these uses. In addition, the results appear to justify the investigation of trends in unit water use on some basis other than time as well as the relationship between total urban water use and time. Although encumbered by many of the same problems, the extrapolation and averaging of annual values from monthly values should prove to be a more reliable system.

Los Angeles

To evaluate climatic influences on per capita water use in Los Angeles, the two climatic zones of the city were studied. Twenty-six years of data for each zone (San Fernando Valley and the city proper and harbor areas) are shown on Figure 9f .

The trends in the San Fernando Valley are rather definite, with summer months showing declining per capita use, winter months showing increasing use, and spring and fall periods showing mixed conditions. The increasing values for the winter months are believed due to increased use of water inside the home resulting from the extensive development of new residential areas and an accompanying increase in the per-household number of water-using appliances.

The downward trend in the summer months contrasts with the upward trends shown in four of the five San Joaquin Valley cities and in the city proper and harbor portion of Los Angeles. Although the basis for this trend has not been thoroughly studied, the nature of land development in the area provides a reasonable explanation. Much of the area is experiencing second-cycle growth, with multiple residential dwellings replacing single residential land use. This sort of conversion increases population densities, reduces the area of greenery, and results in less outside watering, hence, a smaller per capita use. This kind of development, which also occurs in Fresno, is not typical of the other areas studied.

In the city proper and harbor area, the trend of unit water use has been remarkably uniform for each month. The upward trend was disrupted in the early 1950's and during the past ten years has remained essentially unchanged. This pattern indicates that development within the area has become fairly steady. The lack of large seasonal fluctuations is due to the modifying influence of the coastal environment and to a strong industrial base with firm, unchanging water requirements.

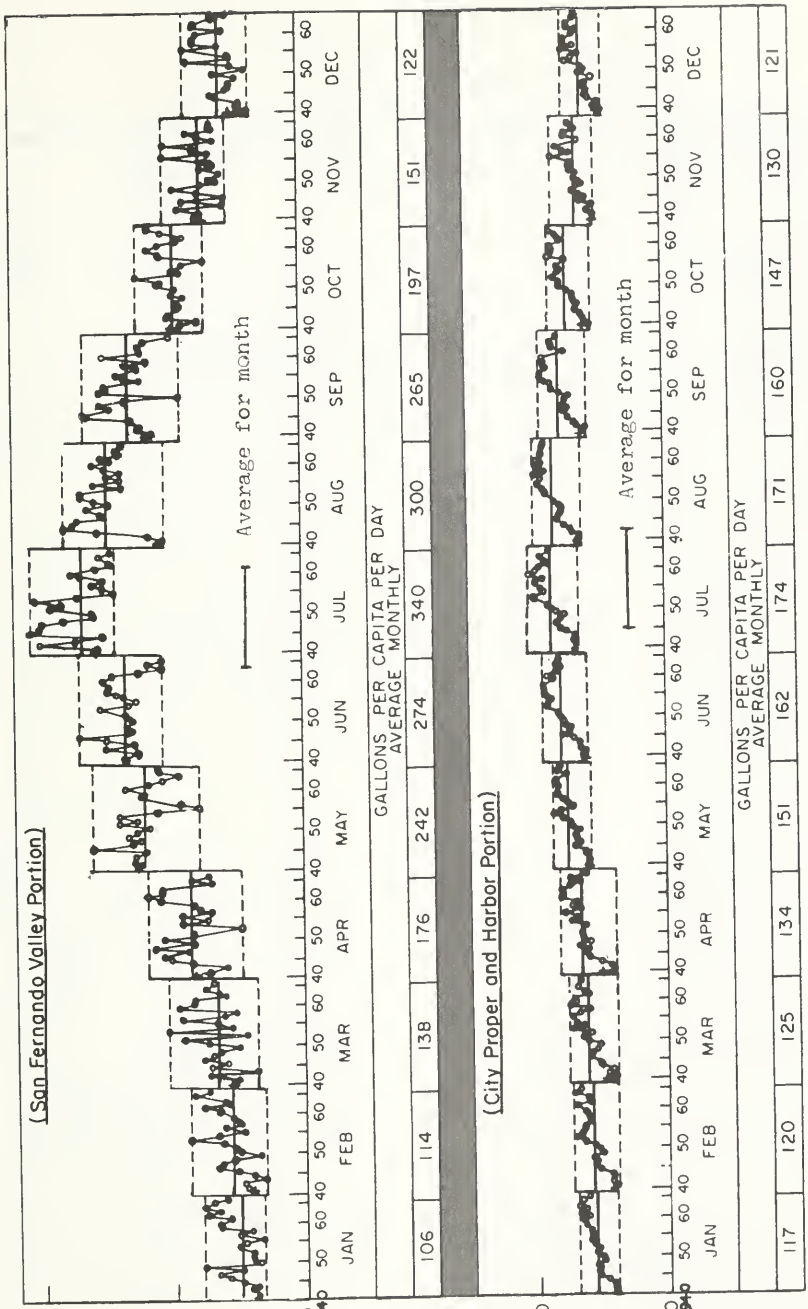


FIGURE 9f

YEARLY FLUCTUATIONS AND AVERAGES OF MONTHLY URBAN PER CAPITA WATER USE
LOS ANGELES, 1940-1965

Trends in Annual Values

Available long-term annual per capita water use values are presented in Table 11. The values generally pertain to cities, but values for a few water districts and metropolitan areas are also included. The locations of the cities and areas are shown on Figure 11.

At first glance, the historic urban unit water use values presented in Table 11 give the impression that per capita water use has increased generally over the past years. Further examination of these values, especially since 1950, confirms this for the North Coastal Area and the San Francisco Bay Area. Although no long-term values were obtained for the Sacramento River, Delta-Central Sierra, and San Joaquin Basins, an increasing trend in unit water use values is indicated in the data presented in Tables 12e, 12f, and 12g of Appendix C, which generally cover the years from 1961-1965. Further, these short-term records are supported by the 15 years of record for Merced in the San Joaquin Basin, which show an increasing trend.

On the other hand, a somewhat different picture is presented for the other areas where values were available. Of the 44 cities reported in Table 11 for the South Coastal Area, Central Coastal Area, and Tulare Lake Basin (excluding Hemet), approximately 10 percent show generally increasing unit values; about 30 percent exhibit generally decreasing values; and approximately 60 percent show little, if any, changing trend. Peak urban water use values were reached by approximately 80 percent of these cities between 1958 and 1962.

An example of a city that has shown surprisingly little change, especially in the last 15 years, is the city and harbor areas of Los Angeles. The average annual unit water use values have varied from 138 gpcd to only 167 gpcd, with a mean of about 158 gpcd during this period. The unit values for 12 years were within ± 5 percent of this mean value, and the maximum was only 9 percent.

Overall, these values cast some doubt on the widespread contention that per capita water use increases with population increase. This contention still may be valid when applied to certain components of urban complexes, such as residential areas and some industries, or to certain cities, but does not appear to be valid for many total urban complexes.

On the basis of the above analysis of the data presented in Table 11, the absence of clearly demonstrated widespread increases in per capita use during the past 15 years in the Central Coastal Area, South Coastal Area and Tulare Lake Basin support the use of the average per capita water use values compiled in this report for these areas.

TABLE 11
HISTORIC AVERAGE ANNUAL URBAN UNIT WATER USE AGENCY PRODUCED WATER

Gallons Per Capita Per Day

Pre - 1939 Data

HA 1/	City or Area and Water Service Agency 2/	F 3/ C	1917 -18 1917	1918 -19 1918	1919 -20 1919	1920 -21 1920	1921 -22 1921	1922 -23 1922	1923 -24 1923	1924 -25 1924	1925 -26 1925	1926 -27 1926	1927 -28 1927	1928 -29 1928	1929 -30 1929	1930 -31 1930	1931 -32 1931	1932 -33 1932	1933 -34 1933	1934 -35 1934	1935 -36 1935	1936 -37 1936	1937 38 1937	1938 -39 1938
SF	East Bay MUD	F	-	-	-	-	-	-	-	-	-	-	-	-	-	74	73	71	70	70	76	84	82	86
		C	60	55	58	60	58	65	69	70	72	75	74	76	80	76	-	-	-	-	-	-	-	-
	Marin MWD	F	-	-	-	-	-	-	-	-	-	-	-	-	-	81	79	78	77	92	86	83	97	
		C	-	-	-	126	110	95	112	111	133	126	117	119	117	86	-	-	-	-	-	-	-	
	San Francisco MWD	F	-	-	71	-	-	-	-	-	-	-	-	-	78	77	72	73	75	83	86	83	89	
		C	-	-	-	68	67	74	73	73	78	80	82	83	83	-	-	-	-	-	-	-	-	
	San Jose WW	C	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	65	62	64	61	65	66	62	
SC	Anaheim MWD	F	-	-	-	-	-	-	-	-	-	-	-	-	115	117	113	112	111	117	126	120	138	147
	Fullerton MWD	F	-	-	-	-	-	-	-	-	-	-	-	-	112	113	110	105	111	99	120	137	146	153
	Orange MWD	F	-	-	-	-	-	-	-	-	-	-	-	-	107	108	104	103	101	96	109	114	122	121
	Santa Ana MWD	F	-	-	-	-	-	-	-	-	-	-	-	-	134	138	124	115	113	103	115	108	121	121

1939 - 1966 Data

HA	City or Area and Water Service Agency	F C	1939 -40 1939	1940 -41 1940	1941 -42 1941	1942 -43 1942	1943 -44 1943	1944 -45 1944	1945 -46 1945	1946 -47 1946	1947 -48 1947	1948 -49 1948	1949 -50 1949	1950 -51 1950	1951 -52 1951	1952 -53 1952	1953 -54 1953	1954 -55 1954	1955 -56 1955	1956 -57 1956	1957 -58 1957	1958 -59 1958	1959 -60 1959	1960 -61 1960	1961 -62 1961	1962 -63 1962	1963 -64 1963	1964 -65 1964	1965 -66 1965
NC	Arcata MWD	C	-	-	-	-	-	-	-	-	-	-	-	75	77	88	93	89	75	107	83	99	100	101	-	-	-	104	102
	Eureka MWD(1903-66, HCSD)	C	-	63	57	60	66	75	81	86	99	87	94	92	98	89	93	93	112	109	105	112	127	113	100	-	122	124	135
	Ferndale WCWC	C	109	107	103	99	110	132	123	128	135	127	136	137	137	128	128	134	138	137	142	135	127	-	-	-	-	-	-
	Fortuna MWD	C	-	65	66	66	67	60	59	55	66	72	78	77	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Garberville GWC	C	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	106	103	108	103	104	105	100	101	98	97	95	-
	Willits PG&E	C	-	-	-	-	-	-	-	-	-	-	-	207	197	162	180	177	139	127	103	103	106	110	101	-	-	-	-	-
SF	East Bay MUD	F	86	87	95	106	114	120	120	124	126	132	126	126	126	126	127	130	133	133	154	156	157	160	158	154	167	171	-
	Marin MWD	F	101	102	100	114	121	130	139	126	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
		C	-	-	-	-	-	-	-	-	116	124	126	139	148	142	140	135	146	143	149	150	150	160	145	149	147		
	San Francisco MWD	F	94	94	94	94	98	100	105	105	102	104	108	101	101	109	111	119	114	112	112	119	125	123	120	118	129	133	135
	San Jose WW	C	68	66	64	64	73	76	84	96	96	96	98	101	111	115	121	126	129	128	132	142	162	151	156	161	146	159	155
CC	Arroyo Grande MWD	F	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	195	232	233	227	275	262	199	168	150	145	144	143
	Attascadero MWC	F	-	220	253	231	265	283	268	242	234	220	210	227	202	190	188	184	182	170	166	207	190	164	149	141	152	155	173
	Lompoc MWD	C	-	115	126	132	152	-	154	155	136	114	132	133	139	144	152	138	134	134	136	153	157	127	133	132	110	139	129
	Paso Robles MWD	F	-	163	269	283	297	299	312	312	300	280	295	289	289	286	257	248	260	279	280	279	287	278	272	248	262	267	270
	San Luis Obispo MWD	F	-	233	253	247	244	150	167	173	206	212	188	205	180	190	190	170	167	158	150	165	166	150	186	151	165	161	177
	Santa Barbara MWD	C	-	139	130	129	127	134	120	125	136	106	121	118	127	138	170	145	157	151	15	150	171	167	182	171	156	170	156
	Santa Maria MWD	C	-	140	142	156	172	174	190	202	203	190	167	158	148	174	195	176	178	186	182	183	190	166	188	190	174	201	182
SC	Alhambra MWD	F	130	111	104	110	114	115	122	122	133	133	134	135	130	140	149	148	149	150	145	156	158	162	152	153	144	139	-
	Anaheim MWD	F	142	147	159	178	180	177	206	221	217	194	184	189	174	164	128	148	133	187	132	156	151	173	150	182	191	182	-
	Beaumont ID	C	-	-	87	146	164	216	156	184	146	187	153	177	175	146	155	146	139	141	109	149	153	163	251	191	168	166	155
	Beverly Hills MWD	F	-	-	239	197	201	200	219	229	271	239	245	219	257	240	233	239	240	272	274	282	330	335	291	329	269	262	-
	Burbank MWD	F	150	163	190	213	205	204	196	193	200	187	197	186	200	225	234	229	229	233	223	243	245	248	239	240	243	233	-
	Claremont SCWC	F	-	183	185	179	170	166	176	198	189	237	254	236	223	272	295	280	297	315	286	366	349	382	332	320	359	335	311
	Compton MWD	F	108	111	110	114	116	125	129	116	120	88	79	73	73	79	88	83	86	86	88	96	96	99	96	96	98	90	-
	Fillmore MWD	F	-	108	108	113	125	129	148	138	156	157	156	162	145	166	166	189	184	190	189	215	209	194	190	178	178	183	192
	Fullerton MWD	F	166	171	204	232	200	195	217	221	225	210	214	222	218	205	250	258	232	242	221	251	232	249	235	241	240	233	-
	Glendale MWD	F	129	124	129	136	140	142	157	179	188	188	185	170	146	161	170	176	184	196	171	174	178	178	163	155	156	154	-
	Hemet MWD	F	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	286	234	225	236	169	261	261	260	247	200	
	Long Beach MWD	F	120	94	96	104	109	120	133	129	133	126	121	121	120	124	114	113	114	118	111	125	137	142	129	130	137	135	-
	Los Angeles MWD (City Proper & Harbor)	C	-	112	107	109	114	119	131	133	134	133	128	138	144	147	160	156	155	162	157	158	167	158	162	154	152	159	152
	Los Angeles MWD (San Fernando Valley)	C	-	182	175	188	194	200	231	224	213	212	196	179	212	196	241	188	184	204	186	204	220	228	214	202	188	201	187
	Monterey Park MWD	F	111	108	104	108	120	124	129	130	150	147	132	136	131	144	144	130	138	117	139	152	151	154	145	139	131	121	-
	Oceanside MWD	F	-	156	150	156	129	149	160	157	154	150	160	138	114	123	144	142	150	146	135	153	146	150	132	145	154	139	-
	Ojai SCWC	F	-	105	126	111	122	132	122	123	135	137	151	156	152	163	155	148	148	158	140	151	156	167	196	155	160	154	160
	Ontario MWD	F	-	169	165	167	186	206	191	208	242	226	228	226	204	222	208	222	191	233	198	227	226	232	207	199	192	198	209
	Orange MWD	F	126	123	132	137	139	137	152	155	159	156	159	164	151	166	158	154	174	165	164	192	187	196	181	181	160	193	-
	Oxnard MWD	F	-	145	134	118	131	135	136	142	165	163	166	164	178	166	148	149	166	146	166	158	148	158	142	152	135	162	
	Pasadena MWD	F	180	168	162	172	182	192	172	203	209	206	208	205	204	225	231	224	228	234	225	253	255	264	244	246	248	243	-
	Pomona MWD	F	-	-	-	-	-	-	-	-	-	-	-	187	196	177	162	175	183	187	178	211	203	205	196	190	164	193	205
	Port Hueneme MWD	F	-	-	-	-	-	-	-	-	-	-	170	125	97	98	92	105	94	127	144	166	153	150	145	158	152	147	158
	Riverside MWD	F	-	164	202	181	181	182	197	206	212	206	208	212	194	202	206	219	220	230	218	244	246	258	246	231	202	197	208
	San Bernardino MWD	F	-	167	171	198	210	223	235	224	221	211	214	225	214	218	229	214	229	214	208	227	206	225	207	206	200	211	213
	San Diego MWD	F	-	93	95	102	113	127	138	120	119	111	140	131	109	124	125	127	125	128	118	128	126	128	118	127	128	129	-
	San Marino CAWC	F	245	237	243	248	244	235	252	254	269	288	303	299	267	286	325	288	297	318	293	341	344	364	350	326	329	322	-
	Santa Ana MWD	F	120	117	118	132	136	130	146	145	152	150	152	152	149	157	161	162	168	166	160	153	149	143	147	147	154	-	
	Santa Monica MWD	F	145	146	132	130	131	126	132	141	141	133	133	136	138	145	145	138	137	149	151	162	160	153	146	150	151	151	-
	Santa Paula WW	F	-	101	112	124	131	153	161	185	177	161	161	155	134	159	142	136	149	149	150	155	137	157	142	135	150	-	-
	Saticoy SWC	F	-	190	191	191	192	195	232	226	209	168	150	158	148	196	181	167	180	164	147	171	141	190	164	119	127	106	92
	Torrance MWD	F	115	110	117	121	148	137	134	154	188	150	150	171	174	166	222	147	148	153	147	149	140	141	139	140	145	137	-
	Ventura MWD	F	-	213	222	212	250	264	271	283	235	233	238	214	201	232	223	212	195	182	176	201	262	216	182	186	183	180	227
	San Diego County Water Authority 4/	F	-	-	-	-	-	-	-	-	125	120	131	122	89	102	133	138	137	132	109	120	122	123	113	122	124	126	-
	Los Angeles Coastal Plain Subunit 4/	F	123	118	119	125	133	145	149	146	152	153	146	153	157	166	166	160	163	163	159	171	171	170	165	164	167	162	-
	San Fernando Valley Subunit 4/	F	159	155	166	168	174	196	201	201	205	195	185	202	193	220	192	185	193	198	192	213	227	210	204	190	197	186	-
	San Gabriel Valley Subunit 4/	F	-	-	-	-	-	192	188	180	188	179	186	186	179	191	193	188	192	193	188	211	212	217	208	204	204	197	-
	Coastal Los Angeles County 4/	F	127	122	124	130	138	154	159	156	161	163	155	163	165	178	174	167	171	172	169	184	187	183	178	174	178	171	-
	South Bay Area CAWC 5/	F	-	72	88	106	125	113	88	104	98	94	97	90	77	89	95	95	97	98	91	97	97	100	96	101	96	-	-
SJ	Merced MWD	C	-	-	-	-	-	-	-	-	-	-	-	-	267	253	267	262	270	265	275	285	312	320	332	324	290	325	324
TB	Bakersfield CWSC	C	-	-	-	-	-	310	304	309	307	295	298	299	302	287	297	312	303	304	308	326	348	334	343	324	299	318	306
	Fresno MWD	C	-	-	331	337	356	348	344	347	350	319	337	348	341	317	315	322	307	329	317	349	374	356	347	327	295	313	306
	Hanford MWD	C	-	-	-	-	-	228	232	234	258	251	287	269	238	247	245	243	246	248	249	237	279	282	260	270	258	274	268
	Visalia CWSC	C	-	-	-	-	-	301	280	271	265	249	271	274	271	265	270	274	258	261	273	296	289	279	264	247	262	260	262

1/ HA - Hydrographic Area

2/ MUD - Municipal Utility District
MWD - Municipal Water Department (except for Marin MWD which is a Municipal Water District)
HCSD - Humboldt Community Service District
WW - Water Works
MWC - Mutual Water Company
WCWC - Williams Creek Water Company
GWC - Garberville Water Company, Inc.
PG&E - Pacific Gas and Electric Company
ID - Irrigation District
SCWC - Southern California Water Company
CAWC - California American Water Company
SWC - Saticoy Water Company
CWSC - California Water Service Company

3/ F - Fiscal Year
C - Calendar Year

4/ Refer to Figure 11 for area covered. Data obtained from San Diego County Water Authority, Los Angeles County Regional Planning Commission, City of Los Angeles Department of Water and Power, The Metropolitan Water District of Southern California, Pomona Valley Municipal Water District, California State Water Rights Board, and Department of Water Resources Watermaster Service.

5/ Includes the cities of National City, Chula Vista, and Imperial Beach.

LOCATION OF CITIES AND AREAS PROVIDING LONG-TERM ANNUAL DATA

APPENDIX A

DEFINITION OF TERMS

APPENDIX A

Definitions of Terms

afpcy - acre feet per capita per year

Applied Water - Water delivered to a user. Also called delivered water. Applied water may be used for either inside uses or for outside watering. It does not include precipitation or distribution losses. It may apply to metered or unmetered deliveries.

Agency-Produced Water - Water pumped or diverted by private or public water agencies; excludes water produced by individuals or companies for self use.

Balanced Community - Several concepts of balance or average condition can prevail in a city or community among the four major types of land use (public facilities, residential, commercial, and industrial). The term may refer to a community with a percentage relationship between zoned or actual use areas of its four land uses that is similar to statewide averages, or it may refer to the average exchange of dollars between the major types of land use compared with statewide averages, or it may have other meanings. In this report a balanced community is one which, from all indications, would be expected to show the same general relationship of gross water use between the four major land use categories as do statewide averages. It does not apply, therefore, to communities with unusually high or low water use, such as might be found in recreational communities or communities with high-water-using industries.

Brackish Water - Sea water or any mixture of sea water and surface runoff which occurs in estuaries or at the lower reaches of streams that debouch into a bay or ocean or other highly mineralized water.

Census Boundaries - Either major portions of counties or small areas into which large cities and adjacent areas have been divided for statistical purposes. Such boundaries are established cooperatively by a local committee and the Bureau of Census and are generally designed to be relatively uniform with respect to population characteristics, economic status, and living conditions. In addition, boundaries are delineated so they seldom require change and can be easily located.

Commercial Establishment - Establishments providing services, engaged in the fabrication of structures or other fixed improvement, or otherwise occupied in nonmanufacturing profit-motivated activities. Examples are retail stores, apartment houses, restaurants, entertainment facilities, and home building concerns.

Commercial Water Use - Water used by a commercial establishment.

Consumptive Use (Urban) - Water transpired by urban-associated vegetative growth and used in building plant tissue; and water evaporated from soils, water surfaces, plant foliage, and impervious surfaces. It also includes water consumed inside homes, commercial establishments, and industrial establishments through evaporation in cooling, cleaning, and food preparation processes. It does not include irrecoverable losses. See also "Evapotranspiration".

Delivered Water - See "Applied Water".

Distribution Losses - See "Unaccountable Water ".

Domestic Water Use - See "Residential Water Use".

Employee - Each person on the payroll of an operating manufacturing establishment for any duration.

Employee Working Days - The product of the average annual number of employees and working days.

Establishment - An economic unit which produces goods or services, such as a farm, a mine, a factory, or a store. In most instances, the establishment is at a single physical location, and is engaged in only one, or predominantly one, type of economic activity.

Evaporative Demand - The collective influence of all climatic factors on the rate of evaporation of water.

Evapotranspiration - The quantity of water transpired by plants; retained in plant tissue; and evaporated from plant foliage, from surrounding surfaces, and from adjacent soil, in a specified time period. Usually expressed in depth of water per unit area. As used in this report, evapotranspiration refers to outside consumptive use.

External Water Use - See "Outside Water Use".

Flat Rate Water - Water sold to customers at a fixed rate irrespective of quantity used.

Fragmentation - An urban area which develops in a scattered or fragmented manner rather than in a uniform manner from existing urban land uses. Also called "Urban Sprawl".

gpcd - gallons per capita per day.

Greenbelts or Greenbelt Parks - Open space areas, which may consist of agricultural lands, forests, reservoirs, park lands, etc., which encircle or border a community. The purpose of greenbelting is to insure that such open areas are protected from encroaching growth and development and, at the same time to help control the physical sprawl of an area.

HA - Hydrographic Area

Household Water Use - All water used within a home for other than personal hygiene and drinking.

Industrial Establishment - An establishment engaged in the mechanical or chemical transformation of inorganic or organic substances into new products, and usually described as plants, factories, or mills, which characteristically use power-driven machines and materials-handling equipment. Establishments engaged in assembling component parts of manufactured products are also considered manufacturing if the new product is neither a structure nor other fixed improvement.

Industrial Water Use - Water used by an industrial establishment.

Inside Water Use - That part of the water delivery used within a home, commercial establishment, or manufacturing establishment for any purpose; also called "Internal Water Use".

Internal Water Use - See "Inside Water Use".

Irrecoverable Water - That portion of delivered water degraded physically or chemically to a level that makes it uneconomical to reclaim, and water discharged directly to the ocean or some other land or water body where it no longer is recoverable.

Manufacturing Establishment - See "Industrial Establishment".

Metered Water - Water sold to customers on the basis of actual measured use; does not include losses in distribution.

Multiple-family Residential Use - A commercial type of establishment including motels, apartments, condominiums, hotels, etc.; residential uses other than single-family dwellings and duplexes.

Municipal and Industrial Water Use (M&I) - See "Urban Water Use" and also "Water Produced".

Net Water Use (Urban) - The sum of delivered water consumptively used and irrecoverably lost.

Outside Water Use - The use of water for irrigation of gardens, lawns, and ornamental shrubs, and for replenishing swimming pools, car washing, etc.; also called "External Water Use".

Personal Water Use - All water used within the home for personal hygiene and drinking.

Persons Per Connection (ppc) - A factor obtained by dividing the total population of a water service area by the sum of residential, commercial, industrial, and miscellaneous water connections. In certain instances, electrical or sewage connections may be used.

ppc - persons per connection

Precipitation - The total measurable supply of water of all forms of falling moisture, including dew, rain, mist, snow, hail, and sleet; usually expressed as depth of liquid water on a horizontal surface on a daily, monthly, or yearly basis.

Private, Industry-Produced Water - Privately produced water used by industries; may include fresh or brackish water.

Privately Produced Water - Water pumped or diverted by an individual or company for self use; excludes agency-produced water.

Public Facilities - All structures, parks, and public places, other than recreational areas, engaged either in serving the public or in providing a public use.

Public Water Use - Water use associated with public facilities.

Recycling - See "Second-Cycle Growth".

Recreational Area - An area predominantely occupied or used on an intermittent basis (e.g., weekends or during the summer) for leisure and/or recreational purposes. Excludes public facilities fitting this definition located outside recreational areas.

Residential Area - In this report, refers to urban areas occupied by single-family dwellings and duplexes.

Residential Water Use - All inside and outside uses of water associated with residential areas.

Second-Cycle Growth - The redevelopment of existing built-up urban areas, or the second time land has been developed for urban uses. Second-cycle growth is usually at higher intensities than first-cycle development. It is also called "Recycling" and "Urban Renewal".

Service Area - The area of land included in the distribution system of an agency.

Sewage - In this report, waste water from sewage treatment facilities; does not include storm and surface waters.

Type of Water Use - A distinction of water use based on either a kind of land use (recreational, residential, commercial, etc.) or on a kind of water use (outside use, personal use, swimming pool use, dishwashing, etc.).

Unaccountable Water - The difference between the quantity of water introduced into the system and the quantity delivered to the eventual consumer; usually expressed as a percentage of delivered water. Many local factors affect this percentage from system to system, but in general, about 10 percent is considered indicative of good management and good conservation practices. See "Water Production and Use Measurements", Chapter II for a list of the important factors.

Unit Water Use (Unit Value of Water Use) - The average quantity of water used per person, acre, etc., over a specified period of time.

Urban Per Capita Water Use - A unit value of water use which encompasses all urban uses of water in a service area.

Urban Renewal - See "Second-Cycle Growth".

Urban Sprawl - Development without clear-cut visual delineations among communities. See also "Fragmentation".

Urban Water Use - The use of water for urban purposes, including residential, commercial, industrial, recreational, military, and institutional classes. The term is applied in the sense that it is a kind of use rather than a place of use. Includes delivered water and unaccountable water. See also "Water Produced".

Water Agency - An agency organized, founded, or established to produce and distribute water directly or indirectly to customers; the two major types are privately owned companies and publicly owned companies. Private companies consist of commercial companies and mutual water groups; public companies consist of water districts and municipally owned water departments.

Water Produced - The total water into the system or the sum of applied water and unaccountable water; also called "Urban Water Use".

Water-Using Plant Area - The portion of a plant, usually in square feet, in which intake water may be used for any purpose and wherein water may be developed, treated, recircultaed, and discharged. It does not include parking, storage, or idle space on the premises, or plant areas in which water has no function.

APPENDIX B

SOURCES OF DATA

APPENDIX B

Sources of Data

The unit values presented in this report have been computed from measured quantities of water produced and estimated numbers of people served.

Water Use Data

Much of the work done under the M&I Water Use program consists of compiling and analyzing water use data from a number of public and private water agencies. Most of the data in this report have been obtained in this manner. Where data were voluminous and awkward to transcribe by hand, records were microfilmed and reproduced for editing later. Where it was impractical to deal directly with a water agency, published reports have been relied on for data.

The State Public Utilities Commission (PUC) reports are a prime source of data on water produced by commercial agencies because of a state regulation requiring each commercial water agency operating in California to submit an annual report to the Commission. Although the main purpose of the reports is to obtain an accounting of commercial water agencies' fiscal operations, physical and statistical data relating to the system are also included.

It is legally required that all commercial agencies report water they produce. However, the quality and completeness of the data vary considerably. Most of the PUC data used in this bulletin came from those companies with the most complete records.

The State Controller publishes an annual report containing information from each incorporated municipality in California. Those cities operating a water service are asked to report data on financial, physical, and operational activities and other data concerning their system. The report is similar in some respects to the reports submitted to the Public Utilities Commission by commercial water agencies. However, it does not contain monthly data, only annual summaries. Because they do not show monthly water use, these data have been used only for evaluating annual water use trends. The records are fairly complete for the Los Angeles and San Francisco Bay areas, where most water is sold on a metered basis.

Generally, the large municipal water departments, commercial water service agencies, and several large water districts have the most complete, reliable, and detailed information

relating to water production and distribution. Since most of the State's population is served from these sources, unit values of use developed from them have wide application.

Mutual water companies and most special districts serving water are not required to report water use data to any central agency. However, they often can provide such data. Some limited data of this kind appear in this bulletin.

Although not used in this report, other sources of water use information include State Health Department reports, United States Public Health Service records, and United States Geological Survey reports.

Population Data

Average annual and/or monthly populations within areas served by water agencies were obtained either from the reporting agencies or the reports they submit. Where values were not available from these sources, they were determined by using a variety of methods that generally may be grouped under the two activities: data interpretation and use of a factor.

In general, the interpretation techniques, consisting of interpolating or extrapolating available population data, gave results which were the least satisfactory and were used only (1) where population could not be easily determined by factoring and (2) where service area boundaries coincided with U. S. Census boundaries. The use of census populations permitted values between 1950 and 1960 census years to be interpolated and for years subsequent to 1960 to be extrapolated.

Because interpolation or extrapolation of the population values in particular years would not detect any unusual population changes such as might accompany the addition of a new industry or college campus, or, conversely, the closing of such facilities, checks were made in the communities to determine such possibilities. Such checks resulted in a number of adjustments to these values.

The method most widely used for determining populations was the use of a factor. This method consisted of multiplying the number of water, sewer, or electrical connections (indicators of population) by a factor relating population to number of connections determined for a census year. This factor is called persons per connection and is abbreviated ppc. Although any kind of connection may be used that tends to increase proportionately with the population, water connections were most commonly used.

Because ppc factors do not always remain constant, factors between regular and special census years were normally interpolated and, for other years, extrapolated.

Data for determining ppc factors were usually given by the water agencies as either number of connections or number of accounts. Number of accounts were not used unless evaluated because a single account, such as an apartment house, could include many water connections.

In water service areas where census boundaries and agency boundaries did not coincide, population determinations became more complicated. Under such circumstances, data on the number of people outside the population unit were obtained by determining the number of connections in the outside area and multiplying by the factor used inside the population unit. The number of outside connections was usually obtained from the water agency. However, in portions of Modesto and Ceres where such information was not available, they were obtained from recent aerial photographs. This approach was used because the area was entirely residential and each home was known to represent one connection. Also, the photographs showed current use and permitted a rapid count of the connections.

Although it is highly impractical and economically unfeasible to determine the exact average population of a water service area for any given year, the various methods described give values that are reliable and quite adequate for most water development planning.

APPENDIX C

MONTHLY AND ANNUAL URBAN UNIT WATER USE

AGENCY PRODUCED WATER

NORTH COASTAL
Hydrographic Area

TABLE 12a
MONTHLY AND ANNUAL URBAN UNIT WATER USE
AGENCY PRODUCED WATER
CITIES

County City	Agency (Name and Type)	Year of Record	Annual Water Into System (million gals.)	Estimated Average Population Served	Average Daily Water Use Monthly (gpcd) Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total Annually gpcd	afpcy
DEL NORTE																		
Crescent City	-MWD	1966	252	5,000	165	143	106	133	151	158	150	157	147	112	87	147	138	.154
HUMBOLDT																		
Arcata	-MWD	1963	-	8,800	-	-	-	94	103	114	131	136	206	98	95	97	-	-
		1964	343	9,000	97	100	95	106	109	105	106	105	114	110	101	99	104	.116
		1965	353	9,400	92	87	99	93	111	110	124	117	109	100	92	88	102	.114
		1966	374	9,600	87	82	87	93	127	130	125	119	111	99	95	87	104	.116
Eureka	-MWD & Humboldt Community Service District (CSD)	1962	-	35,000	-	-	-	-	-	-	161	136	122	105	104	103	-	-
		1963	1,598	36,000	109	103	105	108	111	155	162	142	136	112	110	108	122	.137
		1964	1,704	37,500	102	110	109	116	124	141	149	147	147	124	110	112	124	.139
		1965	1,880	38,300	123	117	119	120	138	161	186	160	122	139	110	117	135	.151
		1966	1,879	39,300	112	121	121	126	142	187	175	170	121	102	95	101	131	.147
Garberville	Garberville Water Co., Inc. (CWC)	1962	39	1,100	69	76	73	85	85	154	152	141	123	75	76	67	98	.110
		1963	39	1,100	72	81	71	71	85	137	155	162	116	81	77	60	97	.109
		1964	38	1,100	68	73	60	76	83	100	167	149	122	102	71	73	95	.106
MENDOCINO																		
Fort Bragg	-MWD	1961	183	5,196	78	89	86	86	85	121	132	115	108	91	83	84	97	.109
		1962	179	5,216	81	78	80	86	106	138	124	106	100	77	74	75	94	.105
		1963	204	5,251	80	82	83	87	109	144	157	146	125	93	87	84	106	.119
		1964	214	5,394	81	87	84	105	108	134	157	149	123	104	83	86	108	.121
		1965	216	5,541	88	89	89	86	120	141	143	138	120	97	86	86	107	.120
Ukiah	-MWD	1961	714	9,641	109	108	109	148	166	348	402	358	277	181	113	107	202	.226
		1962	704	9,712	102	102	102	175	214	338	383	347	246	145	118	101	198	.222
		1963	659	9,853	101	97	101	103	156	316	349	336	258	136	110	123	182	.204
		1964	783	9,909	120	122	126	190	228	316	383	371	286	211	117	117	216	.242
		1965	789	10,099	117	120	129	131	263	330	388	337	291	200	128	128	214	.240
SONOMA																		
Santa Rosa	-MWD	1961	2,008	38,171	101	102	102	133	159	228	255	223	189	158	125	118	158	.177
		1962	2,686	39,322	105	106	100	160	202	241	234	227	183	124	111	101	158	.177
		1963	2,236	40,849	104	103	100	102	132	217	249	249	199	125	112	112	150	.168
		1964	2,760	43,208	106	120	116	163	184	218	265	261	238	194	127	102	175	.196
		1965	2,575	45,507	101	112	75	113	191	210	230	224	212	158	139	99	155	.174

* Refer to last page of Appendix C for abbreviations.

SAN FRANCISCO BAY
Hydrographic Area

TABLE 12b
MONTHLY AND ANNUAL URBAN UNIT WATER USE
AGENCY PRODUCED WATER
CITIES

County City	Agency (Name and Type)*	Year of Record	Annual Water Into System (million gals.)	Estimated Average Population Served	Average Daily Water Use: Monthly (gpcd) Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total Annually gpcd	afpcy
ALAMEDA																		
Alameda	East Bay MUD	1961	2,890	63,855	-	-	-	-	-	-	-	-	-	-	-	-	124	.139
		1962	2,737	63,855	-	-	-	-	-	-	-	-	-	-	-	-	120	.134
		1963	2,727	63,855	-	-	-	-	-	-	-	-	-	-	-	-	117	.131
		1964	2,980	71,000	-	-	-	-	-	-	-	-	-	-	-	-	115	.129
		1965	3,692	73,300	-	-	-	-	-	-	-	-	-	-	-	-	138	.155
Berkeley	East Bay MUD	1961	5,686	111,268	-	-	-	-	-	-	-	-	-	-	-	-	140	.157
		1962	5,523	111,268	-	-	-	-	-	-	-	-	-	-	-	-	136	.152
		1963	5,565	111,268	-	-	-	-	-	-	-	-	-	-	-	-	137	.153
		1964	6,191	120,300	-	-	-	-	-	-	-	-	-	-	-	-	141	.158
		1965	6,411	120,300	-	-	-	-	-	-	-	-	-	-	-	-	146	.164
Livermore	Cal. Water Service Co. (CWC)	1961	997	19,649	76	80	86	139	145	217	243	202	165	143	100	70	139	.156
		1962	1,028	21,013	81	73	77	149	177	212	222	201	167	98	90	74	135	.151
		1963	970	22,498	79	79	88	78	137	202	222	164	172	79	54	74	119	.133
		1964	1,230	23,785	76	99	95	150	177	186	228	220	183	146	76	69	142	.159
		1965	1,333	25,642	74	82	78	89	135	195	220	227	232	163	141	78	143	.160
Oakland	East Bay MUD	1961	18,111	367,548	-	-	-	-	-	-	-	-	-	-	-	-	135	.151
		1962	17,977	367,548	-	-	-	-	-	-	-	-	-	-	-	-	134	.150
		1963	17,443	367,599	-	-	-	-	-	-	-	-	-	-	-	-	130	.146
		1964	18,161	385,700	-	-	-	-	-	-	-	-	-	-	-	-	129	.144
		1965	18,724	385,700	-	-	-	-	-	-	-	-	-	-	-	-	133	.149
Pleasanton	Pleasanton Township CWD.	1964	364	5,850	94	107	106	156	185	218	263	247	229	203	108	121	170	.190
		1965	411	6,200	96	107	124	122	222	245	285	270	234	214	134	117	181	.203
		1966	549	7,925	94	98	128	188	227	261	266	286	249	222	133	118	189	.212
San Leandro	East Bay MUD	1961	3,587	65,962	-	-	-	-	-	-	-	-	-	-	-	-	149	.167
		1962	3,611	65,962	-	-	-	-	-	-	-	-	-	-	-	-	150	.168
		1963	3,323	65,962	-	-	-	-	-	-	-	-	-	-	-	-	138	.155
		1964	4,115	69,600	-	-	-	-	-	-	-	-	-	-	-	-	162	.181
		1965	4,192	69,600	-	-	-	-	-	-	-	-	-	-	-	-	165	.185
San Ramon Village	Valley Community Services District (CSD)	1962	144	4,075	58	67	49	94	114	141	162	129	104	95	69	67	97	.109
		1963	226	5,979	70	73	69	61	100	146	160	158	145	103	74	68	104	.116
		1964	425	9,273	67	81	81	127	147	168	207	178	160	136	68	64	125	.140
		1965	526	11,992	71	72	69	78	155	172	190	179	158	133	86	66	120	.134
S. E. Bay Area	Alameda CWD	1961	2,635	61,184	-	-	-	-	-	-	-	-	-	-	-	-	118	.132
		1962	3,065	71,152	-	-	-	-	-	-	-	-	-	-	-	-	118	.132
		1963	3,720	81,536	-	-	-	-	-	-	-	-	-	-	-	-	125	.140
		1964	4,524	93,196	-	-	-	-	-	-	-	-	-	-	-	-	133	.149
		1965	5,033	99,926	-	-	-	-	-	-	188	177	161	143	98	90	138	.155
		1966	5,581	106,182	95	98	111	155	191	207	190	191	170	144	95	86	144	.161
CONTRA COSTA																		
Antioch	-MWD	1962	1,309	18,776	92	92	104	192	246	272	234	310	332	200	109	98	191	.214
		1963	1,318	19,790	97	95	102	108	198	279	245	285	349	215	108	104	182	.204
		1964	1,475	20,902	88	107	115	197	229	242	246	328	325	253	91	90	193	.216
		1965	1,396	22,348	85	91	101	120	204	217	240	247	316	248	108	93	172	.193
Martinez	-MWD	1962	790	13,851	94	90	99	148	181	211	196	256	240	163	100	94	156	.175
		1963	835	14,530	92	90	94	105	156	210	207	259	253	205	107	103	157	.176
		1964	1,024	15,373	99	108	114	179	202	215	224	280	280	253	115	109	182	.204
		1965	1,082	15,950	104	100	120	126	217	225	239	297	286	254	134	119	185	.207
		1966	1,271	19,455	92	96	117	175	217	250	227	282	257	214	110	114	179	.200

* Refer to last page of Appendix C for abbreviations.

SAN FRANCISCO BAY (Cont'd)
Hydrographic Area

TABLE 12b
MONTHLY AND ANNUAL URBAN UNIT WATER USE
AGENCY PRODUCED WATER
CITIES

County City	Agency (Name and Type)*	Year of Record	Annual Water Into System (million gals.)	Estimated Average Population Served	Average Daily Water Use Monthly (gpcd) Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total Annually gpcd	afpcy
CONTRA COSTA																		
Pittsburg	-MWD	1961	984	19,063	104	81	81	137	133	186	220	201	176	152	129	91	141	.158
		1962	906	19,098	97	84	90	130	151	185	193	187	158	103	99	81	130	.146
		1963	860	19,800	81	82	86	81	118	159	184	193	156	116	88	80	119	.133
		1964	1,076	20,900	74	94	102	141	158	173	209	202	173	156	108	99	141	.158
		1965	1,047	20,900	94	98	101	109	167	172	199	196	167	146	101	93	137	.153
Richmond	East Bay MUD	1961	9,625	71,854	-	-	-	-	-	-	-	-	-	-	-	-	367	.411
		1962	9,494	71,854	-	-	-	-	-	-	-	-	-	-	-	-	362	.405
		1963	9,747	76,300	-	-	-	-	-	-	-	-	-	-	-	-	350	.392
		1964	10,806	79,800	-	-	-	-	-	-	-	-	-	-	-	-	371	.416
		1965	11,246	80,450	-	-	-	-	-	-	-	-	-	-	-	-	383	.429
Walnut Creek	East Bay MUD	1961	618	9,903	-	-	-	-	-	-	-	-	-	-	-	-	171	.192
		1962	700	10,197	-	-	-	-	-	-	-	-	-	-	-	-	188	.211
		1963	750	10,320	-	-	-	-	-	-	-	-	-	-	-	-	199	.223
		1964	1,052	15,668	-	-	-	-	-	-	-	-	-	-	-	-	184	.206
MARIN																		
North Marin Cities	North Marin CWD	1961	658	17,760	59	60	60	87	109	159	186	126	117	106	81	66	101	.113
		1962	880	18,711	56	65	70	141	155	181	196	265	163	100	78	70	128	.143
		1963	860	20,061	65	72	73	67	116	200	212	190	171	93	73	73	117	.131
		1964	1,081	21,593	73	77	85	132	154	172	211	215	196	158	88	78	137	.153
		1965	1,220	24,483	76	84	84	88	180	200	205	208	174	151	92	75	135	.151
South Marin Cities	Marin MWD	1961	7,068	129,000	93	89	96	129	160	213	232	203	187	158	127	108	150	.168
		1962	7,896	135,000	105	109	120	164	194	226	225	217	192	132	122	112	160	.179
		1963	7,493	141,000	117	110	112	104	143	215	205	216	191	127	104	96	145	.162
		1964	8,055	148,000	94	112	114	148	166	178	215	213	195	160	96	94	149	.167
		1965	8,207	153,000	96	104	110	108	180	197	211	200	184	169	107	97	147	.165
NAPA																		
Calistoga	-MWD	1961	175	1,841	130	132	526	330	232	296	344	290	263	208	137	148	259	.290
		1962	173	1,915	137	138	437	206	260	342	349	354	260	157	164	161	247	.277
		1963	146	1,920	157	164	199	147	152	243	309	316	260	188	181	180	208	.233
		1964	126	1,928	187	190	187	147	155	198	261	236	195	163	105	109	178	.199
		1965	134	1,967	178	244	94	87	173	202	262	240	275	196	195	185	188	.211
Napa	-MWD	1964	2,409	40,287	135	130	129	143	207	228	248	259	232	205	139	124	181	.203
		1965	2,841	41,524	118	125	125	123	170	239	242	250	240	181	121	116	171	.192
SAN FRANCISCO																		
San Francisco	-MWD	1960-61	33,452	744,000	135	134	132	123	114	109	113	110	115	121	129	139	123	.138
		1961-62	32,806	746,000	132	131	129	121	111	106	111	112	112	119	126	136	120	.134
		1962-63	32,018	746,000	127	127	126	118	109	104	108	107	110	116	124	133	118	.132
		1963-64	34,978	744,000	141	140	138	129	119	114	118	119	120	127	135	146	129	.145
		1964-65	36,088	743,000	146	144	143	133	123	118	122	119	124	131	140	151	133	.147
SANTA CLARA																		
Mountain View	-MWD	1961	1,585	33,300	84	83	93	129	139	175	185	168	156	136	106	85	185	.143
		1962	1,744	36,000	86	81	88	142	162	177	182	184	160	118	110	98	184	.148
		1963	1,873	40,500	86	89	98	91	130	176	186	180	159	124	105	93	186	.141
		1964	2,214	43,800	99	112	115	146	156	161	184	179	163	144	101	97	184	.151
		1965	2,481	46,800	98	105	123	118	175	183	190	186	173	160	118	110	186	.162
Palo Alto	-MWD	1961	4,275	56,529	127	146	132	175	204	246	309	298	287	217	175	133	204	.228
		1962	4,333	56,932	121	158	125	180	255	285	314	277	274	222	156	133	208	.233
		1963	4,009	57,281	128	137	138	137	139	240	295	293	277	227	151	134	191	.214
		1964	4,602	58,344	131	146	167	195	228	243	299	300	291	247	180	131	213	.239
		1965	4,622	58,652	130	154	146	165	201	208	291	302	299	249	220	134	216	.242

* Refer to last page of Appendix C for abbreviations.

SAN FRANCISCO BAY (Cont'd)
Hydrographic Area

TABLE 12b
MONTHLY AND ANNUAL URBAN UNIT WATER USE
AGENCY PRODUCED WATER
CITIES

County City	Agency (Name and Type) *	Year of Record	Annual Water Into System (Million Gals.)	Estimated Average Population Served	Average Daily Water Use Monthly (gpcd)												Total Annually	
					Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	gpcd	afpcy
SANTA CLARA																		
San Jose	San Jose Water Works (CWC)	1961	20,038	351,288	-	-	-	-	-	-	-	-	-	-	-	-	156	.175
		1962	21,964	372,386	-	-	-	-	-	-	-	-	-	-	-	-	161	.180
		1963	21,533	404,571	100	94	100	95	153	221	237	233	196	131	93	93	146	.164
		1964	25,119	430,589	95	106	111	162	182	205	244	235	215	169	97	89	159	.178
		1965	25,531	449,931	88	97	116	115	199	216	233	226	203	168	106	93	155	.174
Sunnyvale	-MWD	1963	3,551	74,231	94	92	99	91	134	193	201	200	165	118	90	88	130	.146
		1964	4,214	79,217	92	107	114	145	161	173	204	214	169	147	86	92	145	.162
		1965	4,315	81,826	89	99	115	110	182	196	203	203	184	151	102	92	144	.161
SAN MATEO																		
Belmont	-CWD	1961	804	17,000	93	100	104	117	133	157	182	157	141	132	100	92	130	.146
		1962	840	16,930	93	92	106	127	147	166	168	151	142	101	96	84	124	.139
		1963	862	20,000	88	102	91	92	126	162	164	156	137	105	92	91	118	.132
		1964	971	22,000	93	103	109	126	129	166	151	142	154	107	86	88	121	.136
		1965	985	24,000	77	93	93	105	137	155	141	146	134	112	88	80	112	.125
Halfmoon Bay Cities	Coastside CWD	1961	-	3,927	65	81	62	85	85	72	110	99	106	-	-	-	-	-
		1962	127	4,123	67	86	68	79	94	88	98	98	102	72	108	61	84	.094
		1963	154	4,592	74	71	72	97	77	99	110	109	117	111	95	73	92	.103
		1964	165	4,963	61	105	63	79	111	88	81	103	96	103	109	91	91	.102
		1965	178	5,418	88	80	71	95	99	95	100	110	117	121	100	79	96	.108
Pacifica	North Coast CWD	1961	117	21,865	56	73	65	70	72	94	113	110	106	98	91	66	85	.095
		1962	126	24,138	67	71	66	71	96	107	133	102	110	99	87	76	90	.101
		1963	124	25,405	71	78	67	72	73	103	148	135	117	77	83	66	91	.102
		1964	110	22,335	60	68	70	73	93	106	98	112	117	121	90	67	90	.101
		1965	137	31,402	70	74	71	81	74	121	134	129	127	109	102	84	99	.110
Redwood City	-MWD	1961	2,141	46,200	80	91	88	107	114	162	170	167	177	136	131	93	127	.142
		1962	2,221	48,000	81	103	82	102	146	157	172	173	17	137	100	81	121	.142
		1963	2,158	50,000	73	90	88	93	93	147	162	156	168	143	104	85	118	.132
		1964	2,422	52,100	85	95	98	130	142	176	171	169	152	127	91	88	127	.142
		1965	2,566	74,450	86	90	94	91	143	154	161	159	142	128	92	87	113	.153
San Bruno	-MWD	1961	1,590	29,830	-	-	-	-	-	-	-	-	-	-	-	-	146	.162
		1962	1,547	30,810	-	-	-	-	-	-	-	-	-	-	-	-	140	.173
		1963	1,462	33,380	-	-	-	-	-	-	-	-	-	-	-	-	118	.132
		1964	1,511	34,575	85	86	93	107	117	135	140	156	149	137	125	102	119	.133
		1965	1,487	37,200	86	99	94	104	104	136	138	135	141	136	116	85	116	.130
San Mateo	Cal. Water Service Co. (CWC)	1961	3,410	70,940	89	90	88	126	133	188	175	172	157	141	111	90	132	.148
		1962	3,540	71,787	92	93	95	144	165	188	187	183	160	113	107	95	135	.151
		1963	3,417	72,064	100	96	102	94	131	183	191	183	164	118	96	97	130	.146
		1964	3,816	72,200	99	112	112	143	165	176	196	193	173	147	106	97	144	.161
		1965	3,824	72,200	94	97	102	113	133	186	204	198	169	161	137	90	144	.162
SONOMA																		
Sonoma	-MWD	1964	-	3,532	-	-	-	-	-	-	267	262	231	170	105	98	-	-
		1965	222	3,652	92	108	100	109	227	244	238	256	208	173	143	95	166	.186
		1966	271	3,741	86	90	108	170	251	280	276	300	243	206	164	102	190	.213
		1967	-	4,024	113	109	109	94	200	203	-	-	-	-	-	-	-	-
EAST BAY MUD																		
ENTIRE SYSTEM	-East Bay MUD	1961	58,283	988,000	127	124	123	151	168	202	211	200	187	166	141	119	160	.179
		1962	58,222	1,016,000	124	121	124	158	178	198	198	204	185	147	132	119	157	.176
		1963	57,744	1,034,000	124	120	128	121	150	190	207	203	168	151	12	124	151	.171
		1964	64,124	1,052,000	121	136	137	168	176	184	213	221	210	184	140	122	167	.187
		1965	66,784	1,070,000	126	143	149	140	197	201	210	222	205	186	144	133	171	.192

* Refer to last page of Appendix C for abbreviations.

CENTRAL COASTAL
Hydrographic Area

TABLE 12c
MONTHLY AND ANNUAL URBAN UNIT WATER USE
AGENCY PRODUCED WATER
CITIES

County City	Agency * (Name and Type)	Year of Record	Annual Water Into System (million gals)	Estimated Average Population Served	Average Daily Water Use Monthly (gpcd) Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total Annually gpcd	afpcy
MONTEREY																		
Carmel	Cal. American Water Co. (CWC)	1959	368	6,904	105	-	111	-	156	-	190	-	185	-	130	-	146	.164
		1960	351	6,920	98	-	106	-	148	-	180	-	176	-	123	-	139	.156
		1961	385	6,981	108	-	115	-	161	-	195	-	190	-	134	-	151	.169
		1962	55	7,054	104	-	110	-	154	-	187	-	182	-	128	-	144	.161
		1963	340	7,116	94	-	100	-	139	-	170	-	165	-	116	-	131	.147
King City	Cal. Water Service Co. (CWC)	1962	280	2,958	130	149	147	295	337	390	370	383	335	236	209	146	261	.292
		1963	256	2,989	134	130	154	146	274	348	380	379	327	252	160	164	237	.265
		1964	289	3,018	119	177	203	262	284	348	391	421	365	276	136	152	261	.292
		1965	257	3,046	111	105	119	147	188	270	301	333	418	349	278	151	231	.259
Monterey	Cal. American Water Co. (CWC)	1959	863	20,917	86	-	81	-	111	-	141	-	149	-	111	-	113	.127
		1960	865	21,540	83	-	80	-	110	-	139	-	148	-	109	-	110	.123
		1961	927	21,889	88	-	86	-	114	-	144	-	153	-	113	-	116	.130
		1962	948	22,195	88	-	84	-	114	-	145	-	153	-	114	-	117	.131
		1963	900	22,603	83	-	79	-	107	-	136	-	144	-	107	-	109	.122
Monterey Bay Cities	Cal. American Water Service Co.(CWC)	1961	3,583	86,100	83	66	75	117	126	158	159	143	145	129	97	72	114	.128
		1962	3,553	87,700	96	72	79	119	142	146	138	151	122	104	92	73	111	.124
		1963	3,336	89,600	82	68	75	74	107	143	156	143	127	98	79	67	102	.114
		1964	3,615	91,700	78	91	95	115	120	142	146	141	128	108	67	67	108	.121
		1965	3,740	92,300	69	86	83	86	137	150	156	146	143	127	78	70	111	.124
Pacific Grove	Cal. American Water Co. (CWC)	1959	425	11,883	72	-	68	-	96	-	131	-	129	-	93	-	98	.110
		1960	462	12,042	75	-	72	-	103	-	140	-	138	-	99	-	105	.118
		1961	474	12,250	76	-	73	-	104	-	141	-	139	-	100	-	106	.119
		1962	441	12,458	74	-	70	-	95	-	129	-	127	-	92	-	97	.109
		1963	467	12,659	71	-	66	-	100	-	135	-	133	-	96	-	101	.114
Salinas	Cal. Water Service Co. (CWC)	1961	1,732	33,841	91	96	90	107	142	169	190	191	187	164	151	104	140	.157
		1962	1,578	34,320	92	91	74	85	145	183	181	167	186	138	134	105	138	.155
		1963	2,000	34,800	116	101	113	115	157	218	234	223	213	162	116	118	157	.176
		1964	2,098	35,900	107	121	122	156	176	214	228	212	193	170	111	104	160	.179
		1965	2,190	38,800	96	104	104	117	159	193	194	202	212	190	171	112	155	.174
Seaside	Cal. American Water Co. (CWC)	1959	327	10,190	62	-	73	-	100	-	117	-	102	-	75	-	88	.099
		1960	346	10,639	62	-	73	-	101	-	118	-	103	-	76	-	89	.100
		1961	360	10,966	64	-	74	-	102	-	118	-	104	-	76	-	90	.101
		1962	354	11,149	62	-	71	-	98	-	114	-	100	-	74	-	87	.097
		1963	355	11,331	61	-	71	-	97	-	114	-	99	-	73	-	86	.096
SAN BENITO																		
Hollister	-MWD	1960-61	341	6,071	-	-	-	-	-	-	-	-	-	-	-	-	154	.173
		1961-62	356	6,295	-	-	-	-	-	-	-	-	-	-	-	-	155	.174
		1962-63	329	6,525	-	-	-	-	-	-	-	-	-	-	-	-	138	.155
		1964	354	7,058	86	95	99	126	139	161	188	185	203	169	95	98	137	.153
		1965	418	7,306	111	99	113	121	156	184	199	208	261	237	101	89	157	.176
SAN LUIS OBISPO																		
Paso Robles	-MWD	1961	683	6,677	146	148	166	292	310	427	494	444	361	271	173	124	280	.314
		1962	667	6,689	116	142	125	276	338	418	454	453	362	235	198	154	273	.306
		1963	605	6,677	162	146	150	134	240	380	439	446	358	231	152	137	248	.278
		1964	740	7,000	117	165	196	244	323	417	489	462	455	309	144	146	289	.324
		1965	698	7,000	112	149	165	204	369	382	484	458	343	295	175	135	273	.306
San Luis Obispo	-MWD	1961	1,394	21,500	132	122	133	182	196	228	240	226	204	195	162	115	178	.199
		1962	1,398	22,350	100	111	114	184	210	220	222	234	205	164	156	129	171	.192
		1963	1,335	24,100	131	112	120	113	150	194	214	211	188	146	118	125	152	.170
		1964	1,501	25,300	125	149	130	152	168	200	220	205	189	171	120	118	162	.181
		1965	1,527	25,750	112	130	122	131	189	168	213	214	192	197	139	109	160	.184

* Refer to last page of Appendix O for abbreviations.

CENTRAL COASTAL (cont'd)
Hydrographic Area

TABLE 12c
MONTHLY AND ANNUAL URBAN UNIT WATER USE
AGENCY PRODUCED WATER
CITIES

County City	Agency (Name and Type)*	Year of Record	Annual Water Into System (Million Gals.)	Estimated Average Population Served	Average Daily Water Use Monthly (gpcd)												Total Annually	
					Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	gpcd	afpcy
SANTA BARBARA																		
Santa Barbara	-MWD	1961	3,872	59,083	154	174	179	205	222	218	245	239	211	184	142	80	188	.211
		1962	3,888	62,463	120	112	115	170	211	202	215	232	212	163	153	142	171	.192
		1963	3,763	64,500	152	82	147	122	155	161	230	338	188	145	114	144	156	.175
		1964	4,186	66,900	139	142	142	189	190	194	220	219	200	163	115	147	172	.193
		1965	3,939	69,857	117	140	149	120	153	178	202	206	180	196	113	99	154	.173
SANTA CLARA																		
Gilroy	-MWD	1960-61	426	7,348	-	-	-	-	-	-	-	-	-	-	-	-	159	.178
		1961-62	447	7,800	-	-	-	-	-	-	-	-	-	-	-	-	157	.176
		1963	645	8,110	94	90	130	86	169	261	294	275	232	139	95	91	163	.183
		1964	611	9,314	89	110	142	182	212	256	309	263	232	199	99	98	183	.205
		1965	593	9,666	97	100	166	131	245	276	299	242	187	169	99	77	174	.195
SANTA CRUZ																		
Santa Cruz	-MWD	1961	2,292	37,024	93	102	128	147	147	218	246	237	242	211	145	126	169	.189
		1962	2,128	38,448	115	96	96	161	130	177	175	220	207	186	148	107	152	.170
		1963	2,000	38,402	115	97	105	114	125	173	190	201	203	157	121	108	142	.159
		1964	2,446	39,420	128	117	115	165	156	186	220	259	236	210	125	116	169	.189
		1965	2,277	39,863	111	101	112	132	160	166	215	221	198	182	144	130	156	.175

* Refer to last page of Appendix C for abbreviations.

TABLE 12d
MONTHLY AND ANNUAL URBAN UNIT WATER USE
AGENCY PRODUCED WATER
CITIES

SOUTH COASTAL
Hydrographic Area

County City	Agency (Name and Type)*	Year of Record	Annual Water Into System (million gals.)	Estimated Average Population Served	Average Daily Water Use Monthly (gpcd) Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total Annually gpcd	afpcy
LOS ANGELES																		
Beverly Hills	-MWD	1961	3,905	38,540	215	234	258	294	286	336	345	324	305	292	246	192	276	.309
		1962	4,008	39,150	211	188	196	278	299	282	372	408	291	323	274	234	279	.312
		1963	4,566	39,820	328	398	274	301	352	443	340	330	303	264	203	254	313	.352
		1964	4,078	40,505	231	274	249	259	290	288	347	330	310	274	225	230	274	.307
		1965	3,999	41,330	200	222	243	231	288	282	319	343	289	311	227	222	264	.296
Burbank	-MWD	1961	8,236	90,900	196	203	215	243	262	301	331	319	275	254	208	168	248	.278
		1962	8,197	91,800	184	165	177	260	260	274	311	336	288	239	227	208	244	.273
		1963	8,114	92,900	204	195	198	200	243	251	332	322	286	239	192	203	239	.268
		1964	8,337	94,400	190	216	208	222	254	269	335	311	275	256	183	180	242	.271
		1965	8,043	96,034	174	196	203	201	257	246	306	320	233	265	187	165	229	.257
Glendale	-MWD	1961	7,815	120,500	141	134	144	184	197	221	250	234	195	187	145	97	177	.198
		1962	7,226	122,500	116	100	98	172	180	186	220	236	196	154	148	138	162	.181
		1963	6,912	125,500	131	112	126	117	155	155	230	218	186	146	109	121	150	.168
		1964	7,586	128,600	124	139	133	135	172	181	237	220	194	175	115	110	161	.180
		1965	7,170	131,754	103	119	132	119	174	163	213	214	151	180	122	99	149	.167
Long Beach	-MWD	1961	17,579	349,000	118	119	120	139	154	162	175	170	152	142	117	88	138	.155
		1962	16,879	353,000	95	88	94	132	150	154	166	182	155	125	118	107	131	.146
		1963	16,940	357,000	116	99	109	110	136	152	176	176	148	129	102	110	130	.146
		1964	18,630	362,000	108	129	121	137	158	163	184	176	162	141	109	106	141	.158
		1965	18,108	367,500	105	115	113	112	150	154	171	177	149	159	112	100	135	.151
Los Angeles (City and Barbor)	-MWD	1940	56,916	1,392,276	84	90	99	103	121	125	139	136	128	119	104	94	112	.125
		1941	56,092	1,436,231	86	83	83	88	124	130	134	130	126	111	104	88	107	.120
		1942	59,367	1,492,284	88	92	96	89	120	124	137	130	118	115	102	100	109	.122
		1943	65,532	1,574,900	91	90	88	104	127	134	141	141	134	120	114	98	114	.128
		1944	71,044	1,635,640	99	98	105	121	127	134	137	146	134	126	104	109	119	.134
		1945	76,293	1,595,579	112	110	108	128	143	143	152	157	149	135	123	114	131	.147
		1946	79,157	1,630,584	114	118	122	123	135	160	163	163	153	129	115	109	133	.149
		1947	82,458	1,685,913	112	115	118	138	140	149	166	159	146	131	126	112	134	.150
		1948	83,304	1,716,008	117	120	112	120	142	146	160	157	151	134	130	112	133	.149
		1949	82,012	1,755,390	104	105	107	133	135	155	155	158	149	135	119	102	128	.143
		1950	82,548	1,638,829	107	110	126	134	148	160	167	163	143	146	123	122	138	.154
		1951	85,834	1,633,075	117	118	134	134	152	164	177	171	160	158	133	113	144	.161
		1952	89,494	1,667,956	112	133	120	128	162	168	182	183	177	155	128	118	147	.165
		1953	98,330	1,683,739	121	145	149	150	175	183	201	183	173	168	136	142	160	.179
		1954	93,934	1,649,700	126	136	133	140	164	182	203	188	180	158	140	132	156	.175
		1955	94,077	1,662,867	123	133	145	160	146	176	187	198	190	153	138	122	155	.174
		1956	99,081	1,675,648	124	132	151	136	156	185	194	189	187	158	167	148	162	.181
		1957	96,749	1,688,316	126	129	138	149	162	189	200	200	179	147	138	130	157	.176
		1958	99,733	1,729,376	133	121	123	142	170	189	188	184	181	173	150	146	158	.177
		1959	105,558	1,731,730	135	130	154	164	171	190	210	197	181	167	161	142	167	.187
		1960	101,660	1,762,795	128	134	144	161	168	174	199	188	184	164	126	131	158	.177
		1961	104,117	1,760,820	142	146	150	164	175	185	194	190	151	169	147	125	162	.181
		1962	100,010	1,779,229	132	123	126	152	171	169	181	188	170	155	145	140	154	.173
		1963	100,693	1,803,088	143	128	134	136	156	162	187	188	171	156	130	140	153	.171
		1964	105,862	1,824,111	137	149	143	152	170	170	195	186	175	162	133	130	159	.178
		1965	102,213	1,842,339	127	138	137	127	165	165	179	184	162	174	141	127	152	.170

* Refer to last page of Appendix C for abbreviations.

SOUTH COASTAL (Cont'd)
Hydrographic Area

TABLE 12d
MONTHLY AND ANNUAL URBAN UNIT WATER USE
AGENCY PRODUCED WATER
CITIES

County City	Agency* (Name and Type)	Year of Record	Annual Water Into System	Estimated Average Population Served	Average Daily Water Use													
					Monthly (gpcd)												Annually	
					Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	gpcd	afpcy
Los Angeles (San Fernando Valley)	-MWD	1940	7,440	112,001	78	81	109	167	254	271	316	220	237	197	152	104	182	.204
		1941	7,811	122,890	67	92	102	145	249	276	313	212	227	181	160	77	175	.196
		1942	9,506	138,530	85	94	146	118	261	252	402	235	249	157	150	93	188	.210
		1943	10,704	151,170	75	62	73	170	257	302	348	313	243	203	186	89	194	.217
		1944	11,649	159,580	99	80	143	203	242	258	307	364	260	200	117	125	200	.224
		1945	13,420	159,160	118	105	118	216	323	300	416	351	328	186	178	136	231	.259
		1946	14,364	175,686	135	134	155	178	261	342	403	344	334	180	114	110	224	.251
		1947	17,097	219,911	99	127	140	228	249	268	399	304	292	189	156	105	213	.239
		1948	19,033	245,966	156	108	130	168	268	260	368	310	308	177	193	102	212	.238
		1949	21,173	295,958	72	70	101	214	255	272	320	329	270	199	149	96	196	.219
		1950	21,589	330,435	82	101	148	169	235	261	323	296	186	191	126	129	179	.201
		1951	26,400	341,175	84	107	184	168	282	266	385	318	308	218	139	81	212	.237
		1952	25,284	353,428	82	126	90	95	255	272	369	338	298	210	121	102	196	.220
		1953	33,575	381,682	104	176	208	185	282	311	410	337	300	250	151	170	241	.270
		1954	33,194	483,740	94	133	112	147	226	267	345	276	246	188	131	104	188	.211
		1955	35,344	526,261	66	94	134	186	160	255	289	318	271	193	132	105	184	.206
		1956	43,499	584,192	102	123	187	140	187	275	306	278	284	179	207	175	204	.228
		1957	43,148	635,552	84	100	123	164	183	288	322	298	250	147	138	122	186	.208
		1958	49,685	667,274	131	105	100	166	248	299	305	278	267	214	163	160	204	.228
		1959	54,962	684,455	130	114	192	219	240	295	340	302	237	217	206	160	220	.247
		1960	57,327	688,865	117	132	170	239	272	307	357	321	303	234	131	152	228	.256
		1961	60,957	776,106	151	156	168	217	237	292	316	293	246	217	154	115	214	.240
		1962	59,127	802,778	133	112	121	216	216	252	292	308	248	188	172	160	202	.225
		1963	57,414	834,937	156	123	135	141	191	216	298	282	248	178	132	156	188	.211
		1964	63,840	866,768	142	170	156	173	220	238	311	286	239	212	136	132	201	.225
		1965	61,031	896,036	122	147	139	146	224	215	294	276	200	232	134	111	187	.209
Pasadena	-MWD	1961	1,133	117,500	202	195	210	261	281	324	370	364	311	275	215	150	263	.295
		1962	1,076	118,800	170	142	141	249	259	285	350	373	321	239	237	205	248	.278
		1963	1,042	120,200	203	175	196	178	242	240	354	354	393	236	177	195	245	.274
		1964	1,132	121,800	196	218	201	218	268	284	373	358	312	282	176	168	254	.285
		1965	1,051	122,585	163	191	195	193	267	247	337	346	243	292	192	151	235	.263
Pomona	-MWD	1961	-	70,878	-	-	-	-	-	-	283	284	254	231	173	124	-	-
		1962	5,270	72,196	140	122	116	205	206	239	279	294	249	229	161	154	200	.224
		1963	4,819	80,802	140	129	135	133	179	189	244	235	191	150	118	116	163	.183
		1964	5,439	81,409	118	142	127	141	183	213	285	252	235	224	135	138	183	.205
		1965	6,029	82,981	138	156	157	170	231	230	283	289	273	232	153	121	203	.227
Santa Monica	-MWD	1961	4,670	84,300	140	133	138	151	157	170	181	174	166	159	139	113	152	.170
		1962	4,609	85,200	128	118	118	148	160	162	174	181	167	146	145	134	148	.166
		1963	4,709	86,000	150	122	136	136	153	158	181	174	164	150	125	137	149	.167
		1964	4,888	87,200	135	152	141	143	162	156	178	174	174	159	133	133	153	.171
		1965	4,904	88,000	128	138	143	134	165	164	172	179	166	178	139	126	153	.167
ORANGE																		
Anaheim	-MWD	1961	707	114,100	122	127	132	172	185	231	226	225	198	172	140	99	169	.189
		1962	759	123,800	104	94	100	155	175	243	229	248	207	168	148	136	167	.187
		1963	862	133,700	141	122	124	140	181	195	240	234	239	199	139	160	176	.197
		1964	1,130	148,200	137	196	162	191	231	258	300	280	243	215	154	145	209	.234
		1965	1,104	166,000	125	149	148	137	208	218	243	269	215	221	139	115	182	.204

* Refer to last page of Appendix C for abbreviations.

SOUTH COASTAL (cont'd)
Hydrographic Area

TABLE 12d
MONTHLY AND ANNUAL URBAN UNIT WATER USE
AGENCY PRODUCED WATER
CITIES

County City	Agency (Name and Type) *	Year of Record	Annual Water Into System (million gals.)	Estimated Average Population Served	Average Daily Water Use Monthly (gpcd) Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total Annually gpcd	afpcy
ORANGE																		
Fullerton	-MWD	1961	5,494	58,740	198	204	212	280	288	310	324	337	288	271	209	139	255	.286
		1962	5,373	59,300	157	140	150	254	264	289	328	381	315	275	216	206	248	.278
		1963	5,640	64,100	215	163	188	196	259	281	345	344	283	247	180	197	242	.271
		1964	6,837	70,400	185	222	206	240	280	287	378	376	346	303	186	176	265	.297
		1965	6,485	78,030	142	179	192	175	254	265	306	335	272	243	179	135	227	.254
Santa Ana	-MWD	1961	5,846	102,510	111	123	121	164	181	189	203	201	175	160	135	95	155	.174
		1962	5,841	108,630	102	91	96	146	163	176	198	206	179	151	132	124	147	.165
		1963	6,233	113,850	131	111	126	129	170	179	207	206	164	139	107	121	149	.167
		1964	6,832	118,440	114	142	129	145	177	184	221	212	180	161	120	113	158	.177
		1965	6,881	122,040	109	128	125	126	179	186	208	214	170	180	120	102	154	.173
RIVERSIDE																		
Riverside	-MWD	1961	8,524	88,367	176	197	201	281	290	364	381	367	317	268	197	135	264	.296
		1962	8,467	94,817	146	115	129	258	262	315	367	384	314	240	198	187	243	.272
		1963	8,643	103,600	161	145	167	175	261	299	379	345	257	159	164	179	224	.251
		1964	9,572	126,600	137	168	149	177	228	267	338	292	243	218	139	124	207	.232
		1965	9,767	133,200	121	165	150	147	233	246	315	292	242	236	146	108	200	.225
SAN BERNARDINO																		
San Bernardino	-MWD	1961	7,566	92,126	148	163	152	220	246	337	353	312	268	227	157	110	224	.251
		1962	7,236	92,126	128	104	103	219	217	286	329	346	286	208	179	164	214	.240
		1963	6,975	96,400	135	134	148	141	225	244	349	321	234	172	129	142	198	.222
		1964	7,812	100,300	131	161	137	174	226	276	366	327	269	230	138	124	213	.239
		1965	7,649	100,300	124	156	149	164	232	242	336	343	241	251	150	113	208	.233
SAN DIEGO																		
Carlsbad	-MWD	1961	1,332	9,437	228	220	349	336	515	478	572	577	538	403	329	84	386	.432
		1962	1,138	10,150	164	104	95	280	383	402	450	467	437	367	223	262	306	.343
		1963	1,188	11,500	222	179	191	206	360	383	512	494	290	270	106	192	284	.318
		1964	1,219	11,988	164	205	233	246	342	332	397	414	379	292	161	173	278	.311
		1965	1,198	12,500	153	170	276	105	346	358	352	390	329	363	256	97	266	.298
Chula Vista Area Cities	Cal. American Water Co. (C.A.W.C.)	1961	3,717	101,844	73	83	75	83	95	118	116	125	127	114	104	82	100	.112
		1962	3,600	103,256	69	70	60	66	104	107	109	127	125	114	104	90	96	.108
		1963	3,750	106,540	79	87	79	82	94	106	107	128	122	104	92	77	96	.108
		1964	3,974	108,862	76	83	74	85	89	105	118	129	126	134	103	74	100	.112
Escondido	-MWD	1961	1,148	18,438	105	100	110	161	183	224	246	246	210	180	135	84	246	.185
		1962	1,047	20,599	87	76	74	148	124	126	210	229	188	150	140	112	229	.156
		1963	1,231	22,760	101	106	104	122	158	183	242	232	183	141	101	101	242	.166
		1964	1,373	24,921	94	105	95	129	146	202	245	238	192	162	105	93	245	.169
		1965	1,382	27,179	77	87	101	103	160	174	215	219	168	172	113	78	219	.156
Oceanside	-MWD	1961	1,543	26,905	122	121	135	138	166	189	208	208	208	138	158	80	157	.176
		1962	1,342	28,800	84	77	71	102	145	171	179	208	206	142	129	119	136	.152
		1963	1,663	30,005	109	126	130	112	148	168	194	228	196	143	142	123	152	.170
		1964	1,742	31,250	106	126	113	144	167	185	190	185	192	180	131	108	153	.171
		1965	1,873	33,800	95	131	113	102	142	174	197	201	260	183	138	81	151	.169
San Diego	-MWD	1961	27,060	588,400	105	67	107	114	137	146	154	154	142	131	112	85	126	.141
		1962	27,003	616,500	96	81	84	118	124	134	158	161	146	128	110	100	120	.134
		1963	28,662	628,200	106	106	107	115	139	132	162	163	129	128	100	109	125	.140
		1964	29,849	638,400	99	112	106	121	138	146	163	157	148	137	103	101	128	.143
		1965	30,284	648,100	100	105	110	109	145	143	159	177	147	134	106	95	128	.143
VENTURA																		
Oxnard	-MWD	1961	2,491	40,265	135	113	131	139	196	180	172	210	248	181	157	101	170	.190
		1962	2,444	40,300	122	111	88	162	194	186	177	209	207	181	151	134	167	.187
		1963	2,662	43,800	123	91	113	135	152	149	168	179	213	161	120	128	146	.164
		1964	2,872	50,000	126	111	124	136	163	169	178	193	231	183	125	112	156	.175
		1965	3,171	58,269	98	108	104	117	162	187	168	190	215	209	136	113	142	.161

* Refer to last page of Appendix C for abbreviations.

SACRAMENTO RIVER BASIN
Hydrographic Area

TABLE 12e
MONTHLY AND ANNUAL URBAN UNIT WATER USE
AGENCY PRODUCED WATER
CITIES

County City	Agency (Name and Type)*	Year of Record	Annual Water Into System (million gals.)	Estimated Average Population Served	Average Daily Water Use Monthly (gpcd) Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total Annually gpcd	afpcy
BUTTE																		
Chico	Cal. Water Service Co. (C.W.C.)	1960	3,683	29,492	112	106	141	245	342	718	757	667	485	266	132	95	339	.380
		1961	3,781	30,326	96	102	110	270	354	689	803	644	423	292	182	108	339	.380
		1962	3,879	30,330	118	117	140	350	414	644	759	660	475	181	130	112	342	.383
		1963	3,503	31,364	119	117	147	125	319	610	692	642	455	204	115	112	305	.342
		1964	4,183	31,003	141	141	191	357	441	544	752	708	445	338	122	115	356	.399
Gridley	- M.W.D.	1960	307	3,393	162	121	135	199	297	390	518	305	342	210	133	159	248	.278
		1961	337	3,500	104	104	123	245	295	479	543	467	332	228	159	118	266	.298
		1962	331	3,484	127	113	130	248	320	467	526	455	333	175	136	128	263	.295
		1963	300	3,447	132	123	142	131	269	437	487	461	290	170	107	120	239	.268
		1964	348	3,416	112	130	152	259	345	427	515	507	341	240	120	120	272	.305
Oroville	Cal. Water Service Co. (C.W.C.)	1961	1,270	10,200	167	154	155	210	282	533	675	710	570	330	195	168	341	.382
		1962	1,276	10,200	155	143	152	284	320	500	566	730	640	288	186	180	345	.386
		1963	1,294	10,200	163	157	171	157	266	460	536	700	615	246	163	167	318	.356
		1964	1,192	10,200	164	178	190	255	330	430	595	740	645	316	157	154	346	.388
		1965	1,695	10,200	152	157	155	238	307	467	575	730	595	268	78	153	331	.371
Paradise	- I.D.	1957	1,207	9,475	-	88	-	82	-	269	-	1,008	-	568	-	80	349	.391
		1958	1,442	9,985	-	68	-	68	-	380	-	955	-	752	-	167	398	.446
		1959	1,840	10,525	-	81	-	111	-	528	-	1,246	-	636	-	270	479	.536
		1960	1,751	11,300	-	94	-	97	-	303	-	1,049	-	817	-	165	421	.472
		1961	1,855	12,400	-	65	-	113	-	257	-	1,038	-	763	-	202	406	.455
		1962	1,711	13,600	-	89	-	89	-	374	-	751	-	635	-	114	342	.383
		1963	1,435	15,100	-	73	-	74	-	164	-	610	-	541	-	84	259	.289
		1964	1,727	17,100	-	64	-	77	-	271	-	591	-	526	-	118	275	.308
GLENN																		
Hamilton City	Cal. Water Service (C.W.C.)	1960	75	722	105	114	128	226	304	571	567	537	393	244	135	99	285	.319
		1961	79	713	99	97	107	242	361	532	615	778	568	352	169	95	295	.330
		1962	75	713	140	123	135	304	396	517	542	489	372	184	145	131	290	.325
		1963	64	707	130	121	139	116	269	524	565	496	371	181	128	117	263	.295
		1964	86	744	116	143	146	342	403	475	619	557	383	291	107	106	313	.351
Willows	Cal. Water Service Co. (C.W.C.)	1960	404	4,025	115	113	137	211	286	551	547	475	362	235	135	114	273	.306
		1961	400	4,074	110	110	116	236	288	486	564	461	338	240	161	127	269	.301
		1962	381	4,123	123	112	115	233	296	446	526	449	345	156	119	102	252	.282
		1963	382	4,134	111	104	118	112	237	444	513	487	408	180	140	144	252	.282
		1964	460	4,185	142	186	182	300	370	461	598	500	353	277	118	113	300	.336
LAKE																		
Clearlake Highlands	Highland Water Company (U.W.C.)	1961	46	1,153	-	-	-	-	-	-	-	-	-	-	-	-	109	.122
		1962	56	1,272	-	-	-	-	-	-	-	-	-	-	-	-	121	.136
		1963	61	1,332	-	-	-	-	-	-	-	-	-	-	-	-	120	.134
		1964	64	1,500	72	77	80	124	130	190	274	238	201	142	80	80	141	.134
		1965	77	1,606	73	72	83	86	69	203	250	187	168	135	86	89	134	.128
Kelseyville	Kelseyville County Waterworks #1 (C.W.D.)	1961	28	919	-	-	-	-	-	-	-	-	-	-	-	-	83	.093
		1962	30	919	-	-	-	-	-	-	-	-	-	-	-	-	89	.100
		1963	32	919	-	-	-	-	-	-	-	-	-	-	-	-	96	.108
		1964	31	919	35	38	58	49	101	164	168	169	131	90	64	58	94	.105
		1965	32	919	38	54	83	100	146	183	176	121	90	44	37	36	92	.103
Lakeport	- M.W.D.	1961	136	2,392	-	-	-	-	-	-	-	-	-	-	-	-	156	.175
		1962	157	2,481	-	-	-	-	-	-	-	-	-	-	-	-	173	.194
		1963	147	2,570	-	-	-	-	-	-	-	-	-	-	-	-	159	.178
		1964	232	2,658	121	114	125	173	227	426	334	414	300	255	140	102	238	.267
		1965	217	2,797	116	118	124	179	264	295	416	364	243	220	141	137	216	.242

* Refer to last page of Appendix C for abbreviations.

SACRAMENTO RIVER BASIN (cont'd)
Hydrographic Area

TABLE 12e
MONTHLY AND ANNUAL URBAN UNIT WATER USE
AGENCY PRODUCED WATER
CITIES

County City	Agency (Name and Type) *	Year of Record	Annual Water Into System (million gals.)	Estimated Average Population Served	Average Daily Water Use Monthly (gpcd) Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total Annually gpcd	afpcy
PLACER																		
Placer County Foothill Cities	Pacific Gas and Electric (C.W.C.)	1960	1,285	11,007	172	134	134	153	176	336	490	576	500	370	260	156	288	.323
		1961	1,293	11,488	121	134	121	136	177	288	518	571	495	352	258	162	278	.311
		1962	1,421	11,947	138	152	124	147	246	344	500	550	580	394	196	153	294	.329
		1963	1,328	12,025	153	160	142	149	163	297	482	494	500	361	194	175	273	.306
		1964	1,364	12,150	169	186	166	185	252	332	453	547	498	393	296	187	305	.342
SACRAMENTO																		
Sacramento	- M.W.D.	1961	17,626	183,400	158	160	164	218	300	388	434	372	314	267	194	150	260	.291
		1962	18,121	189,500	150	149	160	272	310	382	470	380	331	216	172	149	262	.293
		1963	16,185	189,500	151	148	162	156	229	323	390	392	325	228	152	152	234	.262
		1964	21,162	211,600	137	164	195	238	312	360	450	425	375	285	187	160	274	.307
		1965	21,813	266,800	125	132	162	170	246	330	382	330	320	250	107	136	224	.251
SHASTA																		
Redding	- M.W.D.	1960	1,367	13,336	147	157	178	201	221	474	566	488	329	232	158	144	280	.313
		1961	1,321	14,791	135	131	128	200	181	391	480	440	314	213	167	137	244	.272
		1962	1,402	15,049	149	151	165	225	222	395	544	409	354	151	152	141	255	.286
		1963	1,350	15,114	133	126	132	127	222	398	470	476	339	212	156	134	245	.274
		1964	1,461	15,266	125	142	177	243	282	348	475	476	333	272	132	126	262	.293
		1965	1,442	16,350	124	129	157	136	307	373	454	339	309	273	145	134	242	.270
		1966	1,674	16,080	146	124	133	214	328	454	500	524	372	279	156	134	281	.314
SUTTER																		
Live Oak	- M.W.D.	1958	160	2,210	78	70	64	97	250	338	394	417	292	176	117	97	199	.223
		1959	186	2,244	71	68	120	213	315	433	465	380	231	177	149	102	227	.254
		1960	189	2,290	85	92	105	170	275	460	464	392	279	172	143	77	226	.253
		1961	201	2,323	87	80	90	166	274	368	484	431	412	201	133	115	237	.265
		1962	212	2,356	125	115	120	236	303	416	501	425	345	155	114	98	246	.276
TEHAMA																		
Corning	- M.W.D.	1956	263	2,818	174	160	150	165	204	358	443	413	311	257	212	223	256	.287
		1957	338	2,875	224	221	191	197	249	448	570	697	491	203	204	172	322	.361
		1958	276	2,915	187	149	130	122	202	290	417	471	427	292	213	202	259	.290
		1959	332	2,962	201	206	205	313	284	458	527	455	319	245	258	210	307	.356
		1960	322	3,025	201	167	153	174	180	453	516	535	415	279	205	229	292	.327
		1964	276	2,926	187	149	129	122	201	290	417	471	426	292	213	202	258	.289
		1965	351	3,475	168	164	150	233	261	371	639	326	307	315	187	191	277	.310
		1966	384	3,475	177	167	283	291	365	562	345	553	312	246	154	174	303	.339
YUBA																		
Marysville	Cal. Water Service Co. (C.W.C.)	1960	924	9,534	131	134	143	191	258	483	499	453	350	236	147	142	264	.296
		1961	991	9,951	137	135	140	209	257	465	536	479	338	242	177	135	271	.304
		1962	1,054	10,018	152	165	161	238	300	449	514	474	386	243	200	165	287	.322
		1963	972	9,965	161	153	141	144	260	421	483	477	361	230	181	175	266	.298
		1964	1,089	9,844	176	187	196	270	339	404	514	485	381	297	185	182	301	.337
		1965	1,048	9,900	182	200	164	300	246	400	550	470	320	294	182	173	290	.325

* Refer to last page of Appendix C for abbreviations

DELTA - CENTRAL SIERRA BASIN
Hydrographic Area

TABLE 12f
MONTHLY AND ANNUAL URBAN UNIT WATER USE
AGENCY PRODUCED WATER
CITIES

County City	Agency (Name and Type) *	Year of Record	Annual Water Into System (million gals.)	Estimated Average Population Served	Average Daily Water Use Monthly (gpcd) Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total Annually gpcd	afpcy
AMADOR																		
Amador County Foothill Cities	P. G. & E. (C.W.C.)	1960	306	3,174	190	216	118	213	164	283	365	384	511	343	379	297	289	.324
		1961	341	3,303	200	224	155	144	180	284	293	390	370	362	247	196	254	.285
		1962	447	3,363	166	187	192	170	260	344	425	422	527	419	348	470	328	.367
		1963	519	3,417	238	401	328	282	350	378	493	443	465	449	376	339	378	.423
		1964	468	3,456	245	223	250	232	400	302	370	476	481	394	391	224	332	.372
SAN JOAQUIN																		
Stockton	Cal. Water Service Co. (C.W.C.)	1960	7,482	87,048	111	101	110	175	312	320	382	414	330	300	190	109	243	.272
		1961	7,564	87,575	106	100	112	161	192	291	416	389	413	278	233	130	235	.263
		1962	7,417	88,476	102	111	104	152	232	315	356	373	425	292	303	128	241	.270
		1963	7,014	89,346	111	115	119	124	143	177	341	394	400	287	149	110	206	.231
		1964	7,788	89,346	113	122	136	169	240	288	353	402	411	310	185	120	237	.265
		1965	7,620	89,600	114	115	134	150	208	323	375	340	400	304	217	133	233	.267
SOLANO																		
Vacaville	- M.W.D.	1960	734	10,917	70	98	81	112	213	254	272	312	282	233	162	110	183	.205
		1961	775	11,377	79	66	99	130	186	259	329	316	254	227	171	114	186	.208
		1962	844	11,667	95	94	90	149	212	297	312	314	275	203	188	142	198	.222
		1964	907	14,280	79	98	92	144	179	235	286	293	257	213	106	99	173	.194
		1965	982	14,355	99	98	107	118	215	266	316	305	254	226	145	91	187	.209

* Refer to last page of Appendix C for abbreviations.

SAN JOAQUIN RIVER BASIN
Hydrographic Area

TABLE 12g
MONTHLY AND ANNUAL URBAN UNIT WATER USE
AGENCY PRODUCED WATER
CITIES

County City	Agency (Name and Type)*	Year of Record	Annual Water Into System (million gals.)	Estimated Average Population Served	Average Daily Water Use Monthly (gpcd) Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total Annually gpcd	afpcy
MADERA		1962	-	14,800	-	-	-	284	473	633	689	632	476	300	215	165	-	-
Madera	- M.W.D.	1963	1,844	15,000	167	151	203	191	402	593	668	619	454	262	158	145	334	.374
		1964	2,056	15,300	144	210	221	346	458	577	710	644	453	346	161	141	370	.414
		1965	2,080	16,100	135	162	219	259	498	575	664	612	444	329	179	143	352	.394
MERCED																		
Castle Gardens	U. S. Air Force	1960	316	3,000	64	72	233	361	392	537	585	495	275	217	144	89	289	.324
		1961	310	3,000	64	79	234	271	399	565	559	478	370	195	77	66	280	.314
		1962	285	3,000	70	87	152	277	327	457	510	460	232	228	124	72	257	.288
		1963	320	3,000	55	71	146	356	399	544	587	516	392	174	122	104	289	.324
		1964	332	3,000	123	128	200	176	407	601	610	555	436	209	73	69	298	.334
		1965	398	3,000	95	203	282	393	477	497	703	560	428	374	180	116	359	.402
Los Banos	- M.W.D.	1964	-	9,943	-	-	-	-	-	-	341	318	241	176	109	95	-	-
		1965	745	10,164	100	110	140	145	269	298	341	316	242	228	114	99	201	.225
		1966	761	10,345	88	113	128	194	228	221	332	389	282	219	118	100	202	.226
Merced	- M.W.D.	1951	1,657	17,000	111	111	179	247	318	498	486	457	357	231	144	118	267	.299
		1952	1,708	18,500	103	102	118	167	333	385	496	455	338	251	182	122	253	.283
		1953	1,900	19,500	110	135	177	243	278	374	553	457	370	242	143	123	267	.299
		1954	1,960	20,500	109	112	120	222	341	427	550	427	337	247	130	110	262	.293
		1955	2,119	21,500	101	106	170	126	288	454	493	501	388	248	144	108	270	.302
		1956	2,176	22,500	101	104	182	207	279	469	528	463	351	213	152	123	265	.297
		1957	2,359	23,500	106	108	141	240	284	519	585	504	377	181	135	112	275	.308
		1958	2,497	24,000	104	108	107	185	352	441	554	566	395	287	172	138	285	.319
		1959	2,790	24,500	107	115	190	297	363	550	630	538	330	263	194	147	312	.349
		1960	2,920	25,000	116	117	192	244	384	617	640	572	429	276	128	118	320	.358
		1961	3,042	25,000	119	128	158	290	341	600	687	620	422	313	183	128	332	.372
		1962	3,021	25,500	122	118	150	324	406	563	649	587	428	234	174	127	324	.363
		1963	2,768	26,000	128	127	158	140	315	518	619	582	423	227	127	122	290	.325
		1964	3,158	26,500	123	156	166	248	401	506	670	596	415	323	137	129	325	.364
		1965	3,210	27,000	126	144	186	215	456	529	642	567	412	311	173	132	324	.363
STANISLAUS																		
Ceres	Ceres Water Works, Inc. (C.W.C.)	1961	280	4,100	83	90	101	176	190	323	310	305	263	173	143	86	187	.209
		1962	294	4,400	79	85	84	186	221	303	304	296	263	163	120	84	181	.203
		1963	289	4,600	89	97	101	93	165	288	303	333	256	136	117	79	172	.193
		1964	335	4,700	87	110	103	179	225	269	385	351	265	211	117	91	195	.218
		1965	361	5,000	95	109	127	109	260	290	337	293	279	219	150	92	198	.222
Modesto	- M.W.D.	1961	4,317	33,700	132	145	189	329	351	547	611	603	495	339	212	139	351	.393
		1962	4,573	36,000	131	124	161	358	428	554	605	616	512	320	207	144	348	.390
		1963	4,401	37,800	140	138	168	150	349	524	593	622	547	304	148	132	319	.357
		1964	5,364	39,400	128	173	206	348	432	512	664	682	567	446	160	146	373	.418
		1965	4,956	41,400	134	167	221	224	469	544	670	638	553	418	199	160	328	.367

* Refer to last page of Appendix C for abbreviations.

TULARE LAKE BASIN
Hydrographic Area

TABLE 12h
MONTHLY AND ANNUAL URBAN UNIT WATER USE
AGENCY PRODUCED WATER
CITIES

County City	Agency (Name and Type) *	Year of Record	Annual Water Into System (million gals.)	Estimated Average Population Served	Average Daily Water Use Monthly (gpcd)												Total Annually	
					Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	gpcd	afpcy
FRESNO																		
Fresno	- M.W.D.	1941	8,964	74,200	119	120	155	231	478	580	674	564	457	272	175	135	331	.371
		1942	9,570	77,800	124	133	201	226	420	616	692	592	436	311	154	127	337	.377
		1943	10,525	81,000	124	137	140	263	531	596	680	607	487	318	203	152	356	.399
		1944	10,797	95,000	133	135	245	298	470	569	660	611	477	306	147	135	350	.392
		1945	11,125	88,600	131	134	147	350	475	589	691	593	469	245	165	140	345	.386
		1946	11,678	92,200	134	146	189	381	462	575	654	605	445	245	178	148	348	.390
		1947	12,238	95,800	147	161	258	386	509	575	625	532	449	243	164	149	351	.393
		1948	11,574	99,400	180	170	163	205	340	514	602	554	444	293	213	139	319	.357
		1949	12,670	104,000	142	150	148	368	449	611	641	531	454	316	172	143	343	.384
		1950	13,540	106,600	136	150	218	337	485	582	566	578	426	298	159	139	341	.382
		1951	13,609	111,300	132	139	248	347	441	553	613	553	449	300	185	134	342	.383
		1952	13,114	115,900	123	136	153	239	450	480	593	543	425	325	188	133	317	.355
		1953	13,349	120,700	124	162	220	342	343	439	612	511	436	293	170	141	315	.353
		1954	13,869	125,400	132	138	154	303	453	504	619	521	421	310	170	132	323	.362
		1955	15,027	134,100	119	127	218	253	341	502	536	538	437	298	178	127	307	.344
		1956	16,344	136,100	117	129	248	277	367	568	633	555	464	241	195	146	329	.368
		1957	16,534	142,900	126	130	200	293	308	570	648	558	434	246	153	124	317	.355
		1958	17,515	137,500	124	125	129	256	447	566	664	667	451	362	208	164	349	.391
		1959	19,734	140,000	131	144	265	388	496	630	706	609	411	329	226	172	374	.419
		1960	19,439	149,600	133	134	227	320	446	672	680	603	467	303	147	134	356	.399
		1961	19,699	155,700	133	155	206	328	371	579	667	594	432	320	198	164	346	.388
		1962	19,318	161,900	115	121	163	336	396	554	629	568	447	250	185	145	326	.365
		1963	17,938	166,800	138	138	155	163	326	495	593	552	420	242	179	123	294	.329
		1964	19,633	171,600	119	166	172	284	380	508	614	552	486	304	176	118	313	.351
		1965	19,415	173,700	116	142	182	333	438	445	563	554	535	298	162	109	313	.351
Selma	Cal. Water Service Co. (C.W.C.)	1962	-	7,900	-	-	195	382	422	561	612	582	445	261	199	161	-	-
		1963	927	7,900	179	148	206	181	392	530	625	586	447	257	154	140	320	.358
		1964	1,033	7,900	143	212	221	336	444	574	668	609	425	335	155	139	356	.399
		1965	1,013	8,000	132	175	248	283	495	547	630	599	422	312	179	138	347	.389
		1966	1,083	8,000	145	154	289	428	503	594	615	644	447	314	174	129	371	.416
KERN																		
Bakersfield	Cal. Water Service. Co. (C.W.C.)	1944	5,488	48,500	120	130	231	279	422	476	558	543	432	267	122	110	310	.347
		1945	5,670	51,100	113	111	137	318	396	498	634	532	512	221	153	121	304	.340
		1946	6,156	54,000	123	154	209	325	359	471	569	552	409	238	147	110	303	.340
		1947	6,779	60,500	117	152	211	289	433	503	538	471	416	265	170	118	307	.344
		1948	7,225	67,100	162	174	170	234	321	446	450	449	415	267	185	117	295	.331
		1949	7,886	72,500	120	144	148	315	353	535	565	469	398	250	162	116	298	.334
		1950	8,523	78,100	100	122	202	300	439	476	491	510	389	240	142	101	299	.335
		1951	9,105	82,600	103	131	228	282	392	523	563	505	395	245	163	99	302	.338
		1952	9,040	86,300	91	131	141	224	433	460	573	499	397	272	143	95	285	.321
		1953	9,691	89,400	99	160	209	260	324	436	614	500	420	265	156	115	297	.333
		1954	1,061	91,200	127	139	169	304	475	510	617	497	378	269	150	106	312	.349
		1955	10,805	98,600	102	137	241	269	365	500	542	564	423	266	148	99	303	.339
		1956	11,540	104,000	107	128	240	265	373	521	595	508	416	193	182	122	304	.340
		1957	11,950	107,700	112	137	206	289	345	559	609	531	418	199	139	109	304	.340
		1958	12,467	110,900	108	116	120	231	393	501	610	597	378	307	165	148	306	.342
		1959	14,407	113,100	147	152	281	356	401	572	659	562	386	296	210	146	349	.391
		1960	14,049	114,900	123	128	222	301	411	628	639	576	456	288	126	118	335	.375
		1961	14,609	116,500	130	130	229	356	387	610	646	561	407	292	181	121	343	.384
		1962	14,053	118,300	131	109	184	349	384	541	613	559	422	254	187	127	324	.363
		1963	13,000	118,500	168	160	222	217	384	477	576	538	369	226	137	118	299	.335
		1964	13,983	120,000	112	205	207	272	377	515	606	553	387	300	134	126	318	.356
		1965	13,248	121,200	114	131	204	248	435	467	575	536	373	305	167	118	312	.349

* Refer to last page of Appendix C for abbreviations.

TULARE LAKE BASIN (cont'd)
Hydrographic Area

TABLE 12h
MONTHLY AND ANNUAL URBAN UNIT WATER USE
AGENCY PRODUCED WATER
CITIES

County City	Agency (Name and Type) *	Year of Record	Annual Water Into System (million gals.)	Estimated Average Population Served	Average Daily Water Use Monthly (gpcd)												Total Annually	
					Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	gpcd	afpcy
KERN																		
Delano	- M.W.D.	1961	-	12,300	-	-	-	-	-	-	693	545	430	308	220	103	-	-
		1962	1,782	12,600	134	118	219	383	439	663	647	610	606	335	261	221	386	.432
		1963	1,759	12,900	219	176	281	333	545	522	627	751	375	275	194	163	372	.417
		1964	1,836	13,300	233	282	316	342	438	647	614	579	419	356	119	172	376	.421
		1965	1,822	13,500	121	247	236	309	465	515	730	582	455	377	217	160	368	.412
		1966	2,029	13,968	146	177	428	476	453	593	635	635	465	384	202	163	398	.446
KINGS																		
Hanford	- M.W.D.	1944	816	9,800	115	118	169	201	304	339	398	362	281	201	125	120	228	.255
		1945	855	10,100	118	115	137	247	296	355	421	368	291	183	137	119	232	.260
		1946	897	10,500	115	121	178	232	309	370	417	380	282	165	129	113	234	.262
		1947	1,036	11,000	113	120	186	276	346	388	430	391	326	207	163	144	258	.284
		1948	1,072	11,700	166	171	162	203	276	375	435	398	323	199	155	117	251	.281
		1949	1,278	12,200	126	132	148	288	370	509	538	454	370	239	146	124	287	.321
		1950	1,267	12,900	119	138	180	261	387	443	504	436	295	214	142	110	269	.301
		1951	1,164	13,400	86	118	202	239	303	357	397	375	303	210	148	121	238	.267
		1952	1,244	13,800	111	124	135	209	356	369	479	419	310	212	139	98	247	.277
		1953	1,270	14,200	94	129	196	251	282	362	483	392	320	206	127	109	245	.274
		1954	1,277	14,400	114	113	133	233	338	403	498	383	291	210	122	95	243	.272
		1955	1,320	14,700	90	103	168	223	290	435	453	448	324	198	131	99	246	.276
		1956	1,358	15,000	92	97	191	209	295	439	472	411	327	163	150	121	248	.278
		1957	1,385	15,300	105	112	173	254	297	470	434	415	310	167	97	87	248	.278
		1958	1,349	15,600	85	85	91	165	324	409	470	455	273	224	133	117	237	.265
		1959	1,589	15,600	93	104	200	288	345	487	542	443	309	234	164	150	279	.312
		1960	1,637	15,900	114	110	189	266	370	543	537	464	367	212	112	95	282	.316
		1961	1,777	17,300	98	134	184	293	323	506	511	463	340	258	151	99	281	.315
		1962	1,752	17,700	101	95	130	291	351	462	503	457	341	213	161	130	270	.302
		1963	1,715	18,100	148	129	166	151	327	437	511	472	337	201	115	102	259	.290
		1964	1,873	18,600	109	171	196	264	353	456	515	449	310	252	110	102	274	.307
		1965	1,834	18,700	100	138	214	231	404	426	476	436	300	246	135	105	269	.301
TULARE																		
Tulare	- M.W.D.	1961	1,777	14,300	105	135	205	326	429	638	671	572	408	296	177	111	339	.380
		1962	1,610	14,600	128	115	139	331	395	498	595	519	370	251	159	121	302	.338
		1963	1,555	14,800	172	132	174	163	373	491	573	502	378	226	137	128	287	.321
		1964	1,745	15,100	123	182	221	286	361	569	607	527	360	289	139	115	316	.353
		1965	1,762	15,700	106	150	249	239	402	512	557	545	359	254	181	119	306	.342
Visalia	Cal. Water Service Co. (C.W.C.)	1944	1,274	11,600	144	143	221	239	387	494	537	497	393	260	149	145	301	.337
		1945	1,216	11,900	143	133	149	264	375	452	517	453	375	213	155	130	280	.314
		1946	1,246	12,600	122	137	191	280	351	458	508	429	347	167	143	123	271	.304
		1947	1,315	13,600	94	107	170	298	369	436	470	429	361	201	131	112	265	.297
		1948	1,381	15,200	141	129	134	176	272	403	472	426	344	211	165	109	249	.279
		1949	1,612	16,300	112	110	106	274	350	512	522	427	359	233	139	109	271	.304
		1950	1,734	17,400	99	119	175	273	393	452	535	475	312	222	127	95	273	.306
		1951	1,840	18,400	88	102	181	244	327	491	541	457	362	227	152	111	274	.307
		1952	1,909	19,300	108	128	630	203	406	433	536	471	348	249	142	101	271	.304
		1953	1,934	20,000	108	130	188	273	281	396	547	443	365	218	127	99	265	.297
		1954	2,040	20,700	106	98	118	254	393	460	581	443	335	235	122	93	270	.302
		1955	2,180	21,800	84	94	183	230	336	483	507	523	386	234	137	90	274	.307
		1956	2,156	22,300	85	94	183	174	283	474	539	450	354	176	157	115	258	.289
		1957	2,286	24,000	99	100	147	232	257	521	568	474	349	174	106	96	261	.292
		1958	2,461	24,700	92	92	92	168	355	463	567	573	338	251	147	128	273	.306
		1959	2,787	25,800	98	104	203	305	351	521	607	490	313	241	172	131	296	.332
		1960	2,838	26,900	103	95	165	242	353	598	588	508	389	220	106	95	289	.324
		1961	2,807	27,500	97	132	170	290	320	541	554	479	323	219	134	87	279	.312
		1962	2,724	28,200	90	87	109	275	322	480	538	476	251	183	141	116	264	.296
		1963	2,591	28,600	138	111	139	115	304	436	527	470	353	175	105	91	247	.277
		1964	2,844	29,600	98	154	163	221	320	448	539	467	295	230	102	101	262	.293
		1965	2,883	30,200	94	120	182	194	370	415	497	475	307	233	133	101	260	.291

* Refer to last page of Appendix C for abbreviations.

SOUTH LAHONTAN
Hydrographic Area

TABLE 121
MONTHLY AND ANNUAL URBAN UNIT WATER USE
AGENCY PRODUCED WATER
CITIES

County City	Agency (Name and Type) *	Year of Record	Annual Water Into System (million gals.)	Estimated Average Population Served	Average Daily Water Use Monthly (gpcd) Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total Annually gpcd	afpcy
SAN BERNARDINO																		
Victorville	- C.W.D.	1961	632	5,667	175	166	236	273	341	480	510	459	372	320	199	131	308	.345
		1962	728	6,963	116	118	153	278	272	390	470	489	456	314	217	142	285	.319
		1963	888	8,259	123	147	152	240	308	346	446	581	496	330	186	165	293	.328
		1964	1,171	9,655	138	150	177	285	318	488	562	586	543	344	236	150	331	.371
		1965	1,078	10,850	108	161	197	192	320	407	446	430	384	295	208	93	279	.302

COLORADO DESERT
Hydrographic Area

TABLE 12J
MONTHLY AND ANNUAL URBAN UNIT WATER USE
AGENCY PRODUCED WATER
CITIES

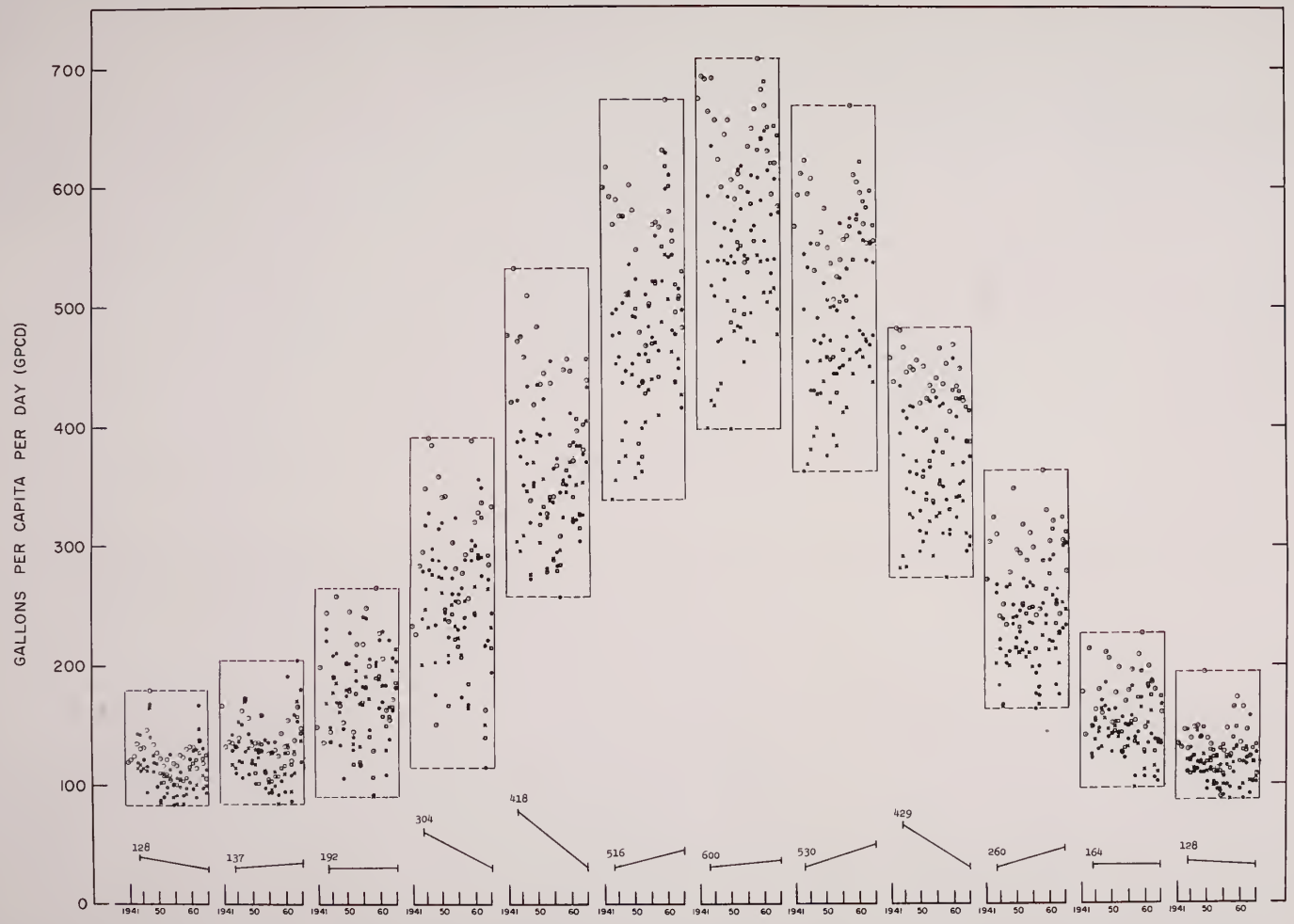
County City	Agency (Name and Type) *	Year of Record	Annual Water Into System (million gals.)	Estimated Average Population Served	Average Daily Water Use Monthly (gpcd) Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total Annually gpcd	afpcy
IMPERIAL																		
El Centro	- M.W.D.	1961	1,626	18,340	147	181	199	246	284	358	356	307	283	214	174	160	242	.271
		1962	1,763	18,340	152	165	189	244	289	373	393	386	340	273	198	149	263	.295
		1963	1,691	18,340	155	192	189	223	314	372	392	346	274	244	170	154	252	.282
		1964	1,632	18,751	128	132	199	224	277	340	383	338	268	238	166	151	238	.267
		1965	1,689	19,414	143	167	187	212	285	329	384	356	301	238	152	116	239	.268
RIVERSIDE																		
Indio	- M.W.D.	1961	1,326	10,150	194	225	249	323	409	596	588	544	433	306	218	207	358	.401
		1962	1,438	11,000	177	178	216	356	381	517	642	603	471	316	246	188	358	.401
		1963	1,390	11,350	181	208	240	292	106	476	591	566	428	295	193	199	315	.353
		1964	1,556	13,450	166	195	208	257	354	450	519	524	397	334	206	183	316	.354
		1965	1,460	13,450	186	219	204	245	339	393	417	471	361	200	138	155	297	.333

* The following abbreviations are used throughout Appendix C to denote the type of agency:

C.S.D. - Community Services District
C.W.C. - Commercial Water Company
C.W.D. - County Water District
C.W.W.D. - County Waterworks District
I.D. - Irrigation District
M.U.D. - Municipal Utility District
M.W.D. - Municipal Water Department
U.M.W.C. - Unincorporated Mutual Water Company

COLLATE:

___/___PIECES

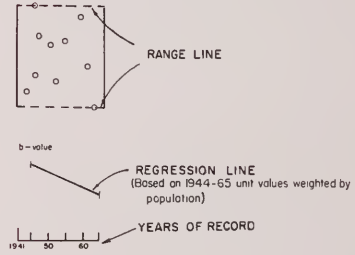


	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
Slope m (from y= mx+ b)	-5.09	2.35	0.17	-14.82	-22.16	6.19	2.48	9.06	-17.40	7.87	-0.17	-1.34
Coefficient of correlation (r)	-0.20	0.08	0.00	-0.19	-0.32	0.09	0.05	0.18	-0.47	0.17	-0.01	-0.05

⊙ FRESNO (Municipal Water Department)
○ VISALIA (Califarnia Water Service Ca.)
☆ BAKERSFIELD (Califarnia Water Service Ca)
× HANFORD (Municipal Water Department)
□ MERCED (Municipal Water Department)*

* MERCED INCLUDED FOR COMPARISON PURPOSES ONLY.

-LEGEND-



STATE OF CALIFORNIA
THE RESOURCES AGENCY OF CALIFORNIA
DEPARTMENT OF WATER RESOURCES

MONTHLY URBAN PER CAPITA WATER USE TRENDS AGENCY PRODUCED WATER, TULARE LAKE BASIN